KNOWING THE NORTH: Reflections on Tradition, Technology and Science

William C. Wonders
Editor

Commemorating the 25th Anniversary of the Boreal Institute for Northern Studies

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William C. Wonders, Editor

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Introduction

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Edmonton, at 53°33'N, is Canada's northernmost large city. By virtue of its geographic location it has long served as a "jumping off place" for the frontier lands of the North, both in the fur trade era of the past century and in the mineral resource era of the present. Its traditional civic slogan, "Gateway to the North," has been well deserved from the time of York boats and river steamers, through the adventuresome years of its pioneer bush pilots to space-consuming efficiency of modern jet aircraft. While the modern city takes pride in its multi-faceted character, it is its "northernness" which still imparts a special quality to it.

Until the 1985 relocation of Athabasca University, the provincial "distance learning" institution, from Edmonton to Athabasca 145 km north, the University of Alberta was Canada's northernmost university. It is natural that many of its faculty and students should have a strong interest in the North. Summer employment there has attracted Alberta undergraduates for many decades. Over the years many faculty and students have contributed significantly to the development of this "final frontier" both as members of the university and as graduates working in the North.

The first suggestion within relatively recent times that the university might formalize its diverse northern interests was in 1955. Officials of the Carnegie Foundation in New York were re-evaluating their financial support for northern institutional research and visited the University of Alberta. President Andrew Stewart requested me to assemble a presentation on the experience and interest among the faculty to document this university's strengths should the foundation decide to fund the establishment of a northern institute in western Canada. This was done, though the foundation subsequently decided not to proceed with the idea.

Interest in the North continued to grow and "Northern Development" became a major political reality in federal government policy. In June 1959, while working on northern research in Ottawa, I was made aware that federal financial assistance might be made available to assist in the establishment of a northern institute at the University of Alberta. I wrote to President Walter H. Johns, who took up the concept enthusiastically. He involved such agencies as the Edmonton Chamber of Commerce and the Chamber of Mines, as well as provincial government officials, in the discussions which followed. Several meetings were held, both with them and with interested University departments, during the summer and fall. A working committee was formed from the participating groups to consider specific objectives and to formulate a report on establishing an institute of northern study at this University. The Committee consisted of Professor W. L. Bigg (Civil Engineering), W. A. Fuller (Zoology), W. D. Gainer (Political Economy), R. L. James (Sociology), and W. C. Wonders (Geography) as Chairman, on appointment by President Johns.

The Committee met weekly throughout December and produced a report which with minor adjustment was accepted by the larger body on January 7, 1960. The major objectives of the Institute were to be "the acquisition and dissemination of knowledge of the North." From the beginning this was to be effected through a threefold program: development of an information centre, provision of training and instructions, and implementation and encouragement of

research. From the beginning, we also wanted it to be of service to the community at large, not just to the university. It was felt that the area of focus should not be confined to either Arctic or Subarctic, nor should it be restricted politically; instead there should be a natural emphasis on Canada's western northlands.

Several names were considered for the Institute, but our choice was immediately curtailed by the announcement of the establishment of "The Institute for Northern Studies" at the University of Saskatchewan. To avoid any subsequent confusion in names we decided in favour of "The Boreal Institute," which was distinctive and clearly indicated the area of focus (at least for those with a minimum classical exposure — recognition that most individuals no longer possess that has resulted in the subsequent addition of "for Northern Studies" to the Institute name).

There are cases where polar research institutes have been attached to specific university departments, and geography with its wide-ranging interests is often involved (e.g., Scott Polar Research Institute at Cambridge University, Centre d'Études Nordiques at Université Laval). This was suggested for our proposed Institute, but I felt strongly that it should clearly be a multi-disciplinary institute with the widest possible contacts and service, and the committee agreed. For the same reason, we felt it should be responsible directly to the president of the university and not come within the jurisdiction of particular schools, departments, or faculties.

It was recommended that there be a full-time administrator as "Director," to carry out the policies established by a five-man "Directorate." The latter was to consist of full-time academic staff representing a cross-section of interested disciplines, with a staggered system of appointment (by the President) to ensure continuity of policy. Provision was also made for an "Advisory Council" of possibly 20 to 40 members, including non-academic as well as academic personnel. It was recommended that a librarian, secretary, and acting director or consultant be hired.

At its January 8, 1960 meeting, the Board of Governors approved President Johns' recommendation for the establishment of the Boreal Institute, and provided a special financial grant for 1960-61 to permit implementation of the report. While the amount was less than the working committee had requested, it did make possible the actual birth of the Boreal Institute.

A final general meeting on January 28, 1960, discharged the working committee. At its request, I submitted to President Johns a short list of ten academics of wide-ranging interests. From it he named the first five-man Directorate: Professors W. A. Fuller, W. D. Gainer, R. W. Longley, R. S. Taylor and W. C. Wonders (Chairman).

Given the limited budget for the Institute's first year, priority went to the establishment of the Information Centre. In this task we received full co-operation from Bruce Peel, University Librarian, who arranged for its housing in Rutherford Library. The Institute's first staff member was Miss L. Carrier, a professional librarian who enthusiastically created the reputation for efficiency and helpfulness which has characterized the Institute Library ever since. A. T. Belcher, recently retired Director of the Arctic Institute of North America, assisted with his advice in this first year of existence.

From the beginning the Institute struggled against limitations in funds. Despite widespread support for its aims, the Institute had difficulties converting interest and enthusiasm into dollars. The subsequent slowing of the program's planned implementation occasionally proved a real embarrassment. "Outside" financial support proved much less than we had been led to expect, and funds that were forthcoming, such as those from the Department of Northern Affairs and from the Yellowknife Transportation Company, were doubly appreciated for that reason.

In the final analysis the continued existence of the Boreal Institute was made possible by the unwavering support of President Johns and his successors and their efforts on its behalf. Those of us who were involved in its formation believed that there was a need for it, and we were confident that it would prove its value to the North and to Canada.

Over the twenty-five years of its existence the

Boreal Institute has fulfilled its original goals to a remarkable degree. Its library and information centre is recognized internationally as an outstanding facility, particularly under its current head librarian, Mrs. G. A. Cooke. Its resources are available to residents of the North as well as serving the University of Alberta. The Institute has provided training and instruction not only at the university, but also in the North as well. For several years special summer schools were offered in the Yukon, in Inuvik, Yellowknife and Hay River, and in Igloolik. The Institute's Boreal Circle Society sponsors an annual series of public lectures on a variety of northern topics.

A map of the location of recent and current northern research projects funded by the Boreal Institute shows a wide diffusion from northern Alberta to northernmost Ellesmere Island and from the Yukon to Ungava Bay. Approximately $175,000 is allocated each year by the Institute to about seventy students for northern research, with eighty-five to one hundred graduate students on campus actively involved in northern research projects at any one time. Many faculty members are called on by industry and government to undertake research in their varied specialties in the North and usually rely on the Institute to provide assistance in their activities, while visiting international northern specialists invariably come to the Boreal Institute for stays of varying length. The Institute provides the secretariat for the international UNESCO-MAB Northern Science Network and also for the recently established Canadian Institute of Nordic Studies.

In recognition of the leading role that the Boreal Institute has played in the University of Alberta's responsibility to the North, the 1986-87 Report of the University Governors featured a review of Institute activities, past and present (Asch and Mackay 1987). The record is an impressive one and augurs well for the future.

To mark its first quarter century, the Boreal Institute organized a major international conference in Edmonton on November 20-22, 1986, on the theme "Knowing the North: Integrating Tradition, Technology and Science." Co-chairmen of the event were Dr. M. M. R. Freeman, Tory Professor of Anthropology and Senior Research Fellow at the Institute, and Dr. W. C. Mackay, Professor of Zoology and Chairman of the Institute's Advisory Board, with Nancy Gibson Conference Coordinator. Six day-long workshops examined specific aspects of the North under the leadership of northern specialists from the University of Alberta, the Canadian Wildlife Service, and Athabasca University. In addition to special exhibitions at the conference site, others were organized at the Institute Library and at the Ring House Gallery of the University of Alberta, and at the Provincial Museum and Archives, while a memorable "Paul Kane Dinner" at Fort Edmonton Park provided participants with an authentic northwest frontier experience.

Distinguished international scholars were invited keynote speakers at the Conference. Their papers, along with one from the new Director of the Institute, Dr. R. W. Wein, Professor of Forest and Animal Science, make up this present volume. The contents demonstrate the great diversity of the North, which so many "outsiders" see all too often in simplistic stereotype fashion. Over the time span of the Boreal Institute's existence there probably has been greater change in the lives of northerners and a greater volume of research work carried out on the North than ever before. We now are confronted with the need to convey more of this knowledge and its implications to southern Canadians and others. In this situation there is an opportunity for the South to learn from the North rather than to assume that only the reverse should be the case. "Tradition, technology and science" in their intimate interrelationships take on particular significance for the Canadian North and the nation.

In their global perspectives the two polar areas are fundamental opposites, the Antarctic being essentially a land mass surrounded by oceans while the Arctic is an ocean area surrounded by land. Dunbar reminds us of the vital importance of the sea in the North, particularly for Canada with its unique extensive Arctic Archipelago and for the Inuit. Indeed it is the sea

which is chiefly responsible for the major geographic subdivision of the North into its two regions, the Arctic and the Subarctic. He suggests that our Arctic seas also provide an opportunity of investigating matters of wider scientific significance — bringing polar ecosystems to bear on evolutionary theory and a possible connection between large-scale oceanic feedback mechanisms and cyclical phenomena.

The general public is increasingly aware of the "greenhouse effect" of growing amounts of CO_2 and other matter in the earth's atmosphere in altering climate. Hare points out that such changes will have a particularly profound effect upon the North. While this potential impact will dramatically improve navigation conditions in Arctic waters, it will also have a major effect on northern ecosystems and Native peoples.

Just as the Arctic seas serve as a focus for the Inuit culture, so the Subarctic land with its extensive forests serves as a focus for traditional Indian culture in the Canadian North. Like the Arctic seas Canada's boreal forest is part of a circumpolar region shared with other northern nations, yet with distinctive features as well. Wein shows that technology also has extended into these areas, with significant repercussions for the Native peoples and others.

Native people in the North traditionally have relied heavily upon its wildlife resources. Despite major alteration in their way of life for many of the people in recent decades, the land and its resources remain a vital matter of concern for all. While the objective of wildlife management is the sustainable yield of renewable resources, outside influences (e.g., firearms, motorized transport, economic demand for only a selected element of local wildlife) have had disruptive effects upon traditional hunting practices of the Native peoples as Nudds demonstrates in his paper.

Feit draws to our attention that the practices of wildlife management in the North have been based upon state-management and upon self-management, concepts which have not always worked smoothly together towards the common goal. Based upon the results of work amongst the East Cree, he argues in favour of improved forms of state-management and a greater encouragement of self-management by the people themselves.

Jacobs also believes that there should be a devolution and decentralization of power from central authority to local in the North, and a furtherance of contact between scientists and local management. In encouraging greater interchange of knowledge about the North, however, he points out that we operate on the bases of certain paradigms which often give different perspectives.

Probably the most visible evidence of northern awareness amongst southern Canadians in the past quarter century is the widespread presence of Inuit art forms, particularly soapstone carvings. Graburn examines the recent history of Canadian Inuit commercial arts in the context of rapidly changing institutions of the North.

Hunt points out that the law and its institutions interact with and influence tradition, technology and science in many ways, especially in the North. As this hitherto often forgotten "third dimension" to Canada's geography has been increasingly integrated into the nation major legal problems have arisen. Northerners and judges have been confronted with the need to meld the concepts of common law which prevail in southern Canada, with the unique conditions and traditions of the North. In the process not only has some unusual jurisprudence emerged for the North, but the North also has made significant contributions to Canadian laws and legal institutions.

Just as the Canadian North is being more effectively tied into the nation as a whole, so too are we recognizing that the nation is increasingly an integral part of the world community, as illustrated by the Chernobyl disaster and the "Black Monday" international financial crisis. Scientists have long recognized that the North particularly has many common characteristics and problems, regardless of the political affiliations of individual segments (Wonders 1976). At the same time programs of international cooperation must operate within national frameworks. In the penultimate article Gjelsvik details the experience in such matters, contrasting the general success in the Antarctic with the lesser achievements to date in the Arctic.

The final article by Hume is a thoughtful reflection on the importance of the Canadian North to the nation. From his initial introduction to this vast area as a recent young university graduate, with minimum knowledge of the region, he went on to rectify that deficiency as a northern resident who travelled widely in the region and developed a deep affection for it and its people. His enthusiasm for the North is not blind to its problems, yet in net balance he stresses the importance of the North to Canada as a nation. A quarter century ago I too stressed much the same in my presidential address to the Canadian Association of Geographers, and called for a "changed way of thinking" about the North with a coordinated overall plan for the long-range benefit of the North and Canada (Wonders 1962). The latter still has not been implemented as we continue our "fits and starts," "bits and pieces" approach. There are encouraging signs however that we are changing our way of thinking about the North, and it is hoped that the present volume will contribute to that process.

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Founding Chairman, The Boreal Institute

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The Sea in the North

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"Behold the sea itself! And on its limitless heaving breast, the ships!" These are the first lines of the text of the Sea Symphony, a choral work by Vaughan Williams. The text of the symphony is by Walt Whitman, but I have been unable to find that particular line anywhere in "Leaves of Grass," nor in the dictionaries of quotations. No matter; the sea is there, and comprises some three-quarters of the surface of this planet, and it is extremely impressive. It is very popular among oceanographers, but it is largely ignored by geographers of all kinds, and even sometimes by climatologists. W.S. Bruce (1911), leader and organizer of the "Scotia" expedition to the Antarctic, expressed this curious fact very well:

> If an expedition investigates 150 miles of unknown land it is said to have made "important geographical discoveries," whereas, if it investigates, with equal if not greater detail, 150 miles of unknown seas, it will be said that the expedition made "no geographical studies."

We live on land and we breathe air, and so the sea is an alien medium to most of us. A recent television broadcast (1986) on lighthouses and life in lighthouses described them as "warning us of the dangers of the sea." Not at all: lighthouses are there to warn us of the dangers of the *land*. Isak Dinesen, in "The Supper at Elsinore" makes the ghost of Morten de Coninck, a former pirate, say: "The earth says yes to our schemes and our work, but the sea says no; and we, we love the sea ever." Isak Dinesen was a Dane, a maritime nation, and it is curious that an equally famous Dane, Hans Christian Andersen, wrote only one of his fairy tales about the sea. That is the story of the little mermaid, and in it he makes the extraordinary zoological mistake of numbering the toad among his marine creatures.

However that may be, we love the sea, especially in the North. "Let me count the ways." The sea is the global mediator of heat, oxygen, carbon dioxide. The atmosphere is always in a hurry. The sea has a slower pace and much greater heat carrying capacity; it is the balancer, the steadier partner. It is vitally important as a controller and moderator of climate and climatic change.

The polar oceans have been given a great deal of attention recently. In 1974 SCOR and SCAR joined in sponsoring the first Polar Oceans Conference, at McGill University in Montreal (Dunbar 1977), and since then there have developed a number of large-scale research efforts, many of them international in scope, in both polar regions, such as AIDJEX, POLEX, MIZEX, BIOMASS, the Fram Strait and the Greenland Sea Projects. The polar seas have entered the world ocean as never before, being recognized as driving forces in the total dynamic of the seas.

The Arctic Ocean itself, in the restricted and proper sense of the Central Arctic Basin bounded by the Canadian Arctic Islands, Greenland, Svalbard, the northern Russian coast and the coast of Alaska and the Yukon, has been recognized as low in biological production for many years, in fact since the FRAM expedition of 1893-96, and even allowing for the recognition in the last 25 years of the surprisingly impressive production of the ice algae (the biota within the sea ice itself), it has held that position ever since. It is therefore interesting to record that our understanding and estimation of the compara-

tive productivity of other parts of the world ocean, in particular the tropical seas and the Antarctic, have changed very greatly during the past few decades. The tropical waters, formerly regarded as rather low in productivity, are now recognized as including some of the most productive regions of all, a point that was vigorously made by El-Sayed in 1974 (El-Sayed and Turner 1977). And the Antarctic, regarded at first as being perhaps the richest region of all, as in the days of Sverdrup (1955), has been seriously demoted (Rodin, Bazilevich and Rozov 1975); so much so that it is now possible for Smith and Nelson (1986) to make the formerly almost heretical statement that "the Southern Ocean as a whole is a region of low productivity."

The Southern Ocean, nevertheless, supports and has supported an important whale fishery, and the standing crop of plankton is at times and places extremely high. The answer to this paradox, as is suggested by Smith and Nelson (1986), is perhaps to be found in the recent recognition of the marginal ice zone as a region of high production. The high production becomes thus a local and intermittent phenomenon, but a very important one. What is true of the Antarctic is also true of the northern hemisphere, more specifically the subarctic or sea areas peripheral to the Central Arctic Ocean. This ice-edge richness of life is in fact not a new discovery in the general sense. Navigators have in the past many times remarked on the sudden increase in life that appears as soon as the ice edge is approached; birds, seals and whales tend to concentrate in this region, and if the early navigators had been equipped with plankton nets they would have discovered a corresponding richness in what would then have been called "lower life." It was suspected for some time that there must be upwelling along the ice edge, and finally wind-driven upwelling was demonstrated on a large scale in the Greenland Sea (Buckley et al. 1979).

But upwelling, which brings plant nutrients to the sunlit zone, is not the only mechanism required to produce phytoplankton blooms. It is necessary also to establish, after the upwelling process, a stable upper layer to contain the phytoplankton, that is, to prevent it, or discourage it, from sinking out of the euphotic zone. This is also accomplished by the marginal ice zone, following on the melting of the ice in spring. As the ice edge recedes, this condition of high production continues over an increasing area. The various possible ways in which the marginal ice zone may promote high primary production are discussed at some length by Smith and Nelson (1986); they include the inoculation of the surface water by algae melting out of the ice.

Polynyas, regions that remain open, or comparatively ice free in winter, are in one sense a special case of the MIZ. In the North Water, the large polynya (a large area of open water, surrounded by sea ice, and found in the same area every year) in Smith Sound and northern Baffin Bay, upwelling has been indicated by the work of the North Water Project group that studied this region by airborne methods, based at McGill University and at the ETH Institute in Zurich (Ito 1981, Steffen 1985). The latter author has recorded sea surface temperatures in winter well above the freezing point, clear indication of the advection of heat from below. For a general discussion of the significance and probable causal mechanisms of polynyas, see Stirling and Cleator (1981) and Dunbar (1981). Upwelling caused by wind has already been suggested as operating in polynyas, but vertical exchange of water in polynyas caused by the leaching out of salt from freezing surface water has been suggested as possibly more important. This mechanism seems to have been first put forward by Russian workers, notably Kupetskii (1962). Although polynyas are by definition ice-free, or poor in ice, they are nevertheless ice factories in which the surface water is constantly freezing during the winter, the ice so formed being equally constantly removed downwind. Leaching out of salt from the new ice causes high salinity at the surface. The result is sinking of high salinity water, causing vertical exchange which brings heat to the surface from down below.

The vertical exchange, however, must bring plant nutrients to the upper layers as well as heat, so that this mechanism may be the explanation of the surprisingly high biological fertility of Lancaster Sound. The North Water itself, together with Jones and Lancaster Sounds, forms a very large polynya-complex, and Lancaster Sound is

downstream from the North Water, receiving therefore both heat and nutrients from the latter. No wonder Lancaster Sound has come in for much attention from biologists and conservationists. It can be regarded as the jewel in the marine Arctic crown, and should certainly be exempt from industrial intervention. "Northern Perspectives" (CARC 1986), volume 14, number 3, is devoted to Lancaster Sound; the subtitle reads: "After decades of confrontation, research, public reviews, and indecisive government policy, a land-use planning process is at last underway in Lancaster Sound." My only quarrel with this statement is the term "land-use"; it should be "sea-use."

In terms of their effects on global climate and climatic change, the polar seas are not to be outdone by the tropical phenomenon of El Niño. Most of the sea water in the world is below 5°C — the tropical and subtropical seas form a comparatively shallow lens overlying this cold mass. Polar and subpolar regions constantly resupply the cold water in areas of sinking. The Labrador Sea is one known region of this bottom water formation, and there is an intermittent overspill of cold water from the Greenland Sea across the sill between Greenland and Iceland. The Greenland Sea as a whole is suspected of forming bottom water within itself. Hunkins (1986) reviewing the collection of essays entitled "The Nordic Seas" (Hurdle 1986) writes: "Several chapters touch on the fascinating question of the importance of this region [the Greenland Sea] to global climate. Cold, deep waters formed in these seas flow outward to influence the ocean at locations far from their origin.... Deep water formation is important since the ocean, with its high heat capacity, acts as a thermal buffer on climate." The Antarctic deep water formation is probably the most important heat sink in the world, and the interplay between the Arctic water flowing out of the Arctic Ocean and the waters of the North Atlantic controls to a large extent the short- or mid-term changes of climate in that region. Moreover the sea as a carbon dioxide sink plays a clearly significant but not yet fully understood role in the CO_2/climate story we hear so much about at this time.

To turn to less specialized matters: The traditional Inuit culture and history are based on the seas of the North. The dispersal route from the Palearctic to the Nearctic, to use Alfred Russel Wallace's classical terms, followed the coastlines from Siberia to Greenland. To the Inuit, the sea was the chief source of food, mainly the sea mammals. The caribou took them inland on hunting excursions, seasonally, but the staple diet came from the sea, and to a large extent still does. The Inuit are in fact the top predators in the northern marine ecosystem. Men and women for all seasons, they have developed especially the art of using the resources of the winter, and in this they have emphasized and developed the use of snow and ice, for shelter and transport and as a hunting platform. The present scientific interest in sea ice, particularly its biological significance, is thus in harmony with a human ecology of long history. Ice is a resource, and the waters of the Arctic should be looked upon as "ice-enriched," not "ice-infested" or any other derogatory term. Sea ice is a hindrance to the extraction and transport of hydrocarbons from the North, but that is a recent and temporary development.

So important are sea water and sea ice to the Inuit, in fact, that I am surprised there is so little talk of "sea-claims" as opposed to, or as well as, "land-claims." I have no doubt that international law experts would wax excited about this, but that is their worry, not that of the People. I can see that a serious Native claim to a body of sea water, or a channel, would be something new and perhaps difficult to negotiate, but the Inuit of Canada are Canadians, so that the waters concerned would remain in the same national ownership as they are now, and moreover they would be in good hands ecologically. My experience with cold sea water, which began in 1935, has convinced me that the Native population has developed, long ago, a sound and deep appreciation of the structure, the strengths and the weaknesses, of the natural systems of which they are a part, both on land and in the sea.

This brings me to another point, perhaps a digression, perhaps not. On reading Hugh Brody's "Maps and Dreams" (Brody 1982), about Indians in northern British Columbia, I was

struck by his description of how they go about planning a hunting expedition and by the similarities between this process and the way in which scientists go about planning and conducting scientific research — the real scientific method, not the method still ingrained in the public understanding of science. He writes: "Between a proposal to go hunting and actual departure there is a large and perplexing divide," and goes on to say that in the southern industrial mind "protests against the hunting way of life have often paid hostile attention to its seemingly haphazard, irrational, and improvident nature," and that the southerner's mind "has immense difficulty in understanding what planning means for hunters of the North." Brody's point is that one must recognize that the most important variables relevant to the proposed hunting expedition are "subtle, elusive, and extremely hard or impossible to assess with finality." Finally the hunt moves off, after discussion that has lasted several days. "The hunter moves in a chosen direction; but, highly sensitive to so many shifting considerations, he is always ready to change his directions."

The parallel between this and the method of science is remarkably, and instructively, close! Moreover, similar indecisiveness and hesitation on the part of scientists have frequently drawn puzzlement and even scorn from the business and industrial world. But the results of the method, scientific and Native, have always been satisfactory in the long run.

The non-renewable resources of any region will, by definition, ultimately fail. It is therefore upon renewable (living) resources that we should lavish our attention and our care. It would be foolish to destroy the renewable resources in the course of extracting the non-renewable. By the same token it is extremely important that the living resources should be used in such a way as to ensure their permanent existence and value. This has become a platitude, but there is one aspect of the matter that needs to be explored further, namely the present conflict of interest and viewpoint between the hunters, or "exploiters" on the one hand and the "animal welfare" groups of whatever stripe on the other; this with particular reference to the North. Much publicity has been given recently to the damage done to Native hunting economies by the collapse of sealskin and other fur markets as a result of the sustained attack by "special interest" groups on the harp sealing industry east and west of Newfoundland, and on trapping. It must first be made clear that the harp seal is in no danger of extinction. Government science has ensured that the allowed quota of the industry is (was) set to maintain the stock at a high level. The public has been misinformed on this point, as on others. Secondly, it is appropriate and fitting to examine the motives of those who have developed the campaigns of propaganda relative to the sealing industry; and thirdly, it is essential to support the Native peoples whose legitimate and ancient interests have been severely hurt by the propaganda. I would include with the Native interests those of the Newfoundlanders themselves.

Environmental pollution is high in the public mind these years, and rightly so. In the application of this to the northern seas, as in other Arctic marine matters, there has been much recent published coverage, the most recent being the Spring 1986 issue of the Woods Hole Oceanographic Institution's journal "Oceanus," in which several authors have dealt with sea ice, marine pollution, ecosystem organization, and the Arctic Ocean's significance in climate control. Also the recent workshops sponsored by DIAND have discussed exhaustively the possible environmental hazards associated with oil and gas exploration and development in the Beaufort Sea area. These are only two of many publications of the past five years on the Arctic marine zones. There is no point in summarizing all this material here, even if there were space. The "Oceanus" article by Vera Alexander (1986) on Arctic Ocean Pollution is particularly recommended to those who would explore this subject further. The world ocean is, after all, downstream to everywhere else in the world, and is therefore the final sink of much unhealthy stuff. Its vast size and volume tempt us to ignore the dangers, but they cannot be ignored any longer, even in remote areas.

In preparation for this Conference, invited speakers were asked to provide papers "integrative in nature, raising issues and applications of research, theories and techniques that

extend beyond the confines of commonly accepted disciplinary boundaries." I have two offerings that might fit this bill. One is to bring polar ecosystems to bear on problems of evolutionary theory, and the other is the possible connection between large-scale oceanic feedback mechanisms and cyclical phenomena, both physical and biological. Both are fairly speculative, but I hope that they may provide food for thought.

It is no longer news that the classical Darwin-Wallace position on the mechanism of organic evolution, involving natural selection at the individual level only, has come up for much questioning, broadening and interpretation in the past decade or two. Strong evidence has been brought forward for the importance of group selection, that is, selection between groups within species (Wynne-Edwards 1962, 1986), and for selection at the community level (Ott 1981). There have also been proposals for mechanisms involving the entropy principle which go beyond the individual selection level (Wiley and Brooks 1982). Selection at the whole ecosystem level was first suggested by Dunbar (1960, 1972, and in press). Polar environments, because of their clear and large-scale cooling beginning in the Miocene, offer a space-time laboratory which is unique, in that the response of the ecosystem can be studied in comparison with the ecosystem response in the warmer climates, which have remained steadier and which therefore can be used as the control in this evolutionary experiment.

Environmental change as a force evoking biological change, including evolutionary change, has been recognized as far back as Lamarck, in some sense also among the early Greek philosophers. It was a key element in the thought of Darwin and Wallace. The change in temperature, and more importantly in annual seasonality, that followed upon the Tertiary climatic cooling had extremely important effects on the marine and terrestrial ecosystems of the mid and high latitudes, especially the latter. Life spans of poikilothermal (cold-blooded) animals were lengthened and the breeding cycles had to be adjusted to the much shorter annual period of algal and other plant growth. Diversity of the system (richness of the fauna) was forced down to allow a smaller number of species to produce a larger number of individuals in order to ensure specific survival to the next phytoplankton bloom. There would also be expected an altered plankton/benthos biomass ratio, probably to the advantage of the benthos. Such changes could conceivably have been brought about by selection at the individual level alone, but there is, to many biologists, an improbability attached to such a process that is compelling. It is at least just as probable that the process involved selection at the ecosystem level, causing the extinction of whole systems and the survival of others. See also Jablonski (1986) for suggested differences in selection type and survival during "background" periods of stable environment as compared with periods of large environmental change (such as that in the later Tertiary).

On the subject of oceanic feedbacks and cycles, I have to refer back to an early paper of mine (Dunbar 1950) which attracted very little attention, which simply pointed out that the total water circulation of the earth's surface is a dynamic open system in which many subsystems can be recognized. The whole complex of circulations is strongly influenced by unstable and local atmospheric conditions so that distortions and overloadings occur in its several parts, which can be relieved only by overflow into adjacent circulations, these being sufficiently elastic to absorb, for a time, the surplus water. To quote from that paper: "Cyclical effects in water circulations, of periods amounting to decades or even centuries, may well operate by means of such interplay between adjacent circulations," and "it is in the study of cyclical effects that the feed-back systems in the sea become particularly relevant."

That was in 1950. In the same year Arne Lindroth (1950) published a monograph on the changes in abundance in the Atlantic salmon in thirteen rivers in northern Sweden, publishing his "salmon curve" (Figure 1). To quote from his paper:

> The astonishing conformity, pointed out already by previous authors, is apparent. Whether the rivers are regulated or

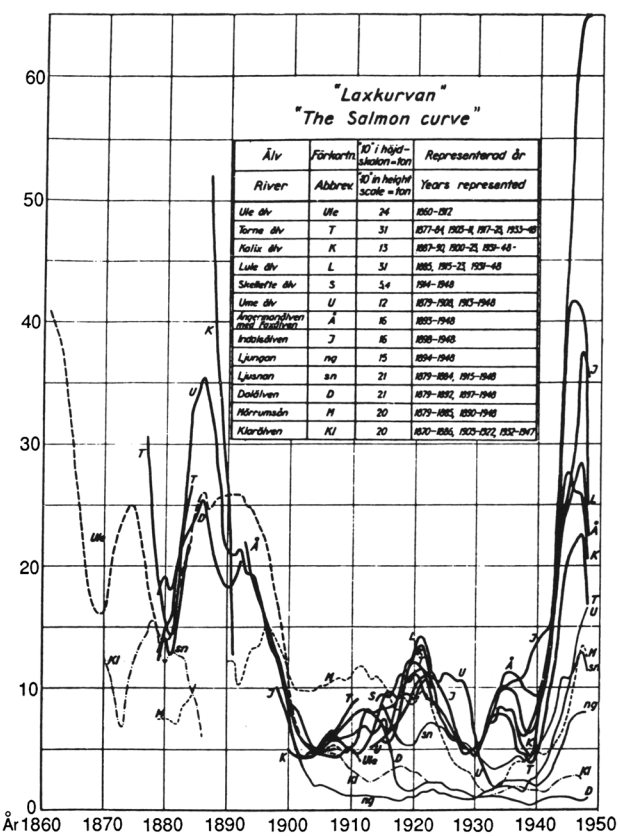

Figure 1. The "Salmon Curve" for Northern Sweden. From Lindroth (1950).

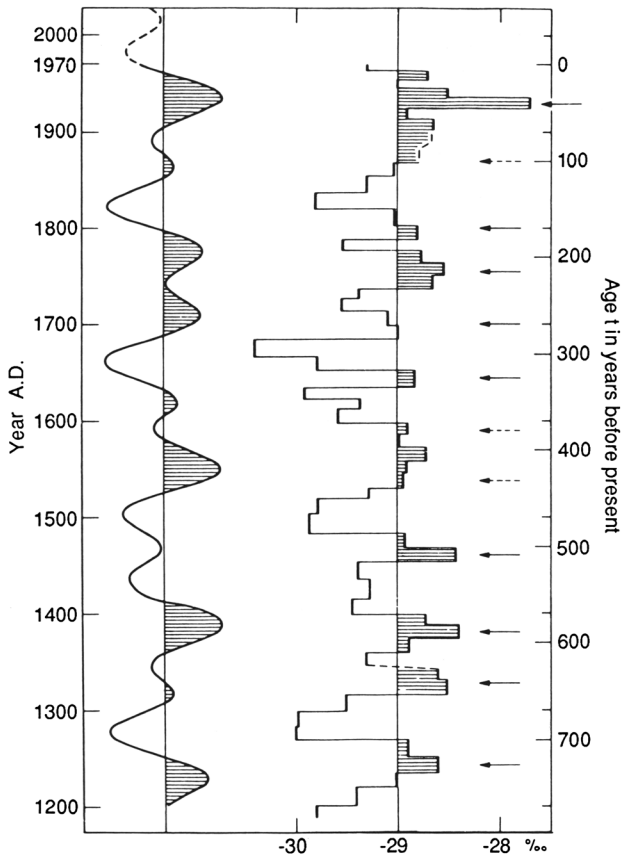

Figure 2. Right: *Oxygen-18 Increments from an Ice Core from Camp Century, Greenland Ice-cap.* The hatched areas correspond to relatively warm periods. Left: Synthesis of the two harmonics that dominate the right-hand curve, smoothed. From Dansgaard et al., (1971).

> unregulated, pure or polluted, with or without accessory artificial propagation, the trend of the catches in most of them is very similar. It is thought that this must be due to one or both of two main causes: similar variations in the factors at work in the different rivers, or variations in conditions in the Baltic, where the stocks from the rivers mix.

Lindroth's curve shows peaks in the late 1880s and in the mid 1940s, with a smaller rise in 1920. The 60-year period between peaks is the same order as has been found recently in a number of marine species (see Steele and Henderson 1984; Dunbar 1985). Moreover, the history of temperature changes since 1200 A.D. derived from the Camp Century ice core in North Greenland (Dansgaard et al. 1971), shown here in Figure 2 reveals peaks of warmer climate with periods of from 60 to 85 years, with a mean of 76.6 years. One leading student of climatic oscillations and their biological effects is Vibe (1967, 1982, 1984), who interprets these events and effects not from the starting point of direct temperature variations, but from variations in the output of sea-ice from the Arctic Ocean, on the thesis that this outflow has a variation with peaks on various time scales, one of which involves a period of 58 years. It seems that we should pay some attention to these phenomena, and attempt to establish the ecological factors relating such cycles in the species involved, the understanding of which would greatly increase our ability to regulate the use of the renewable resources of the North.

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Climate in the North: Prospects for Change

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The Dynamical Background

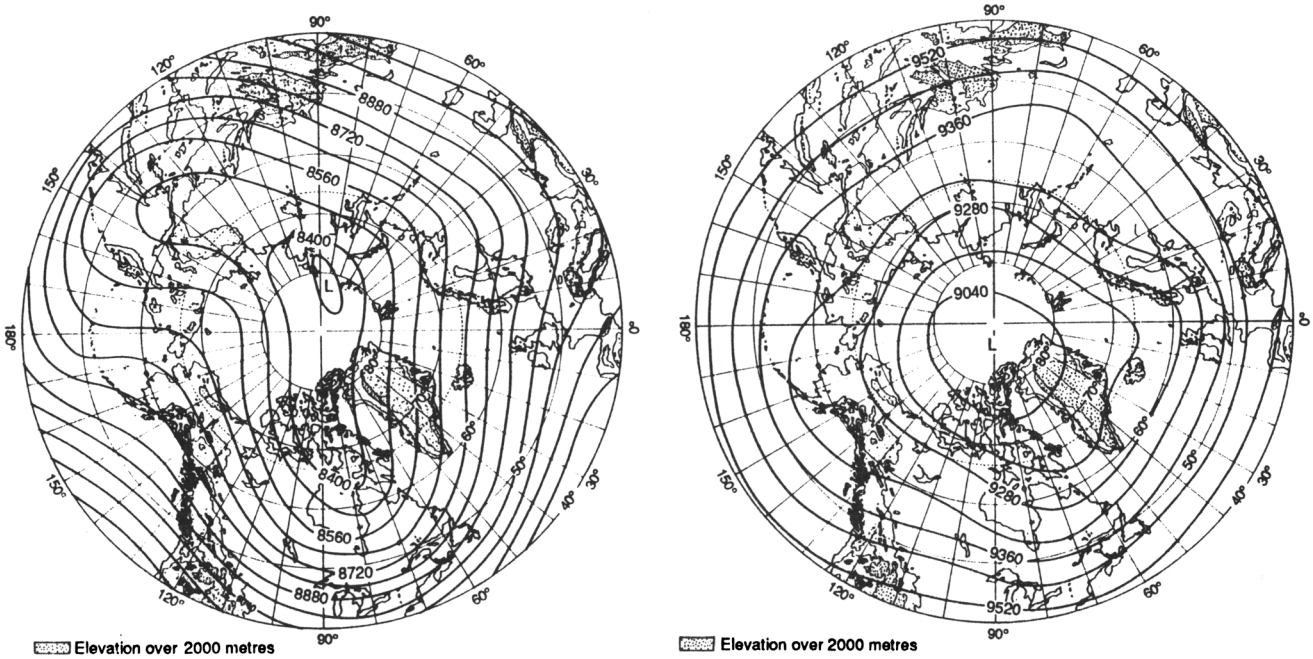
The geographical Arctic lies below the core of the vast westerly wind vortex that encircles the Pole. A similar system, even larger and more intense, encircles Antarctica. These twin westerly belts are the most striking feature of the atmospheric circulation. Most intense between 9 and 14 km above sea-level — the altitude of the jet-streams — the westerlies are the permanent consequence of the earth's rotation about the polar axis, and of unequal heating and cooling between latitude belts (see Figure 1, after Barry and Hare, 1974).

At low altitudes — below 3 km — the single cyclonic vortex of the northern hemisphere splits into two smaller systems, the Icelandic and Aleutian low pressure systems (the latter, however, vanishing in summer) (see Figure 2, after Barry and Hare, 1974). But the overwhelming reality is still that the troposphere and lower stratosphere of both hemispheres spin around the poles, at angular velocities greater than that of earth below. The frictional drag of these westerlies carries the ocean surface waters along with them, and creates in both hemispheres oceanic convergences that deliver cold high-latitude waters to the deeper levels of the ocean, which are cold in all latitudes.

There are several common fallacies about the atmosphere and surface in high northern latitudes. One is that there is high pressure at the pole, and hence a circumpolar belt of easterlies. For much of the year this is untrue. Only between April and June is high pressure common over the Arctic Ocean, and only then is there a real approach to a belt of polar easterlies. At other times the latter are broken into segments, one over the Bering and Beaufort Seas, Alaska and E. Siberia, and the other across Svalbard, Bear Island and on to Novaya Zemlya. Averaged around the pole these winds hardly exist as easterlies — and when they do exist, they form parts of the cyclonic flow around the Icelandic and Aleutian lows (Hare 1968; Barry and Hare, 1974).

Another fallacy is that the Arctic surface is the radiative heat sink for the hemisphere. Again this is untrue. On the annual average, incoming absorbed solar heating equals or very slightly exceeds the net infrared cooling of the surface; the mean annual net radiation, or radiation balance, is near zero, or may be slightly positive. The real heat sink for the earth is the middle and upper troposphere in all latitudes, notably at the top of the cloud layer. Arctic air temperatures are low because of the lack of net heating. But the orbiting satellites do not detect the high latitude belt as the source of the strongest outgoing radiation. We had deduced this before satellites were in orbit; but it is nice to have empirical confirmation that our figuring was right.

The circumpolar westerlies are at all times complicated by transient or slow-moving disturbances (the cyclones and anticyclones of the daily weather map). These often penetrate the Arctic, which is thereby invaded from time to time by airstreams from mid-latitudes. Particulate pollution (chiefly from Europe) is often carried northwards in this way, producing the arctic haze that has been increasingly observed in recent years. On the other side of the coin, air that



Figures 1 and 2. Mean height (gpm) of the 300 mb surface for (a) January, (b) July (after Crutcher and Meserve, 1970). The resultant wind blows almost parallel to the contours at a speed proportional to the gradient with lower heights to the left of the wind vector.

has been refrigerated over the Arctic pack-ice, or over the continental interiors, regularly flows south-eastwards into mid-latitudes, notably in the frigid winter monsoonal outbreaks over eastern Asia and central and eastern Canada. The persistence of northwest winds over much of the Canadian eastern Arctic actually exceeds that over parts of east Asia; Canada has a true if unrecognized winter monsoon.

On the whole, however, high northern latitudes have a climate that presents little to excite the dynamicist. The lower troposphere is dominated for much of the year by strong temperature inversions that inhibit convection, and the less stable conditions of summer have sluggish circulation (with surface temperatures anchored near 0°C over the thawing pack-ice). The most important aspect of the surface is the seasonally fluctuating margin of the polar pack-ice, whose high reflectivity to solar radiation is one of the major controls of the general circulation (as are the associated sheets of low stratiform cloud so extensive along the Arctic margins) (see, e.g., Manabe and Stouffer 1980; Manabe and Wetherald, 1986).

The Antarctic is quite different, being an elevated ice surface at all seasons, surrounded by a continuous ring of ocean over which cyclonically-driven storm systems are always present. The remarkable climatic asymmetry of the earth, with differing polar hemispheres, arises from this geographical difference.

Considered as an element in the human environment, it is the surface climate that matters most — yet the dynamic meteorologist can summon up little enthusiasm for an interface that is, from his or her point of view, largely inert, low-energy and rather homogeneous. The human economy of the North, indigenous and externally-directed alike, nevertheless depends closely on the surface climate, which is one of the most demanding on earth. Even more so does the patchwork quilt of terrestrial and marine ecosystems. All these relationships are now faced with the probability of climatic change in the next few decades, on a

scale unknown for millennia. This change will be driven by world-scale processes induced by human interference. The latter is most effective in mid-latitudes — but it will be in high northern latitudes (according to most of the research models) that the changes will be most profound.

The Greenhouse Effect

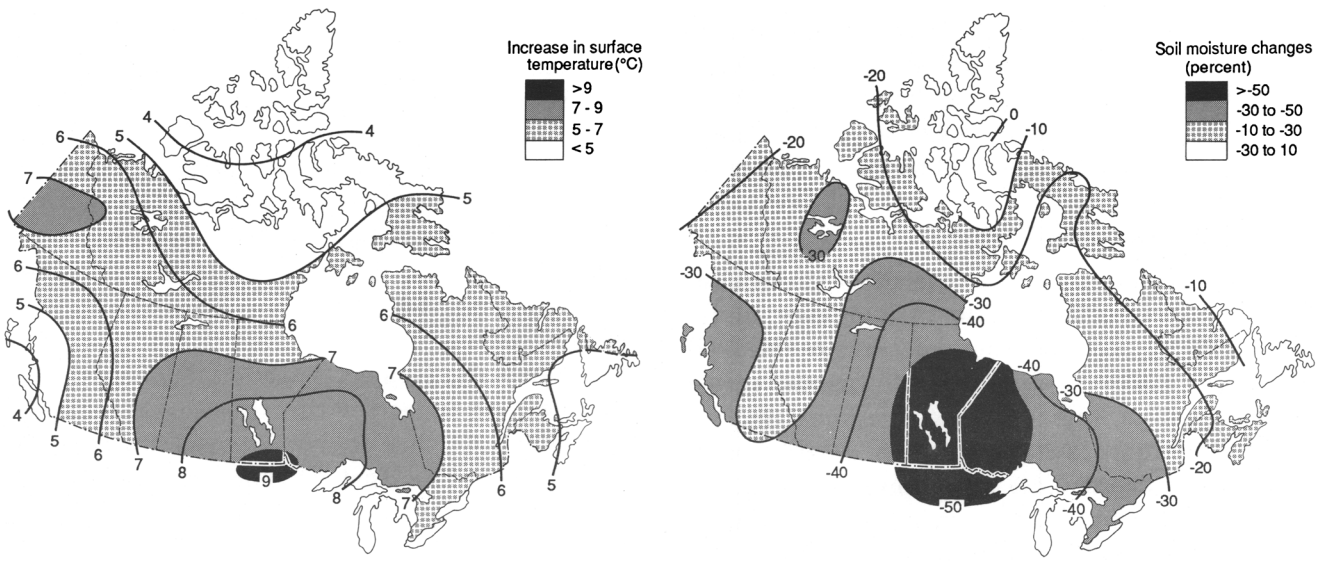
The greenhouse effect consists of surface and tropospheric warming due to increases in the atmospheric concentration of certain infrared-absorbing gases — chiefly water vapour, carbon dioxide, ozone, nitrous oxide, methane and the synthetic fluorocarbons. Carbon dioxide is increasing at about 0.4% per annum, now making up about 349 ppmv of the atmosphere (in which it is uniformly distributed, in spite of the concentration of combustion releases in northern mid-latitudes). Methane, nitrous oxide and the fluorocarbons are also increasing, though their concentrations are much smaller. The net effect of these increases, at predicted future rates of release, may be to double the total effective concentration of infrared absorbers by as early as 2030 — and such a doubling may raise mean surface temperatures by 1.5° to 4.5°C. Much of this will actually derive from the extra evaporation of water vapour, itself an important greenhouse gas (for an extended view, see WMO-ISCU-UNEP 1986).

Recent work at the University of East Anglia has shown that the mean air temperature near the earth's surface has increased by about 0.4°C in the past century. This estimate includes sea and land surface observations from about three-quarters of the planet, and has been carefully corrected for land-sea observational differences, as well as the local influence of urbanization. The warming is similar in the two hemispheres, though the northern hemisphere's record contains more short-term variability. The three decades ending in about 1970 showed a pause — unexplained — in the warming trend, but the past decade and a half showed strong warming, and several of the 1980s have been the warmest of the entire record. In the North the record is much more variable, and no clear trend is yet visible in all areas. In any case, arctic areas are characteristically prone to decades-long fluctuations of temperature and ice conditions (Jones et al. 1986).

Most research climatologists are now persuaded that this lengthy, slow and regionally-variable warming trend is probably at root the greenhouse effect at work — though few authorities will stick their necks out and say so. The only reasonable alternative explanation would be an increase in the solar constant, which has not been observed, or a major change in the role of the oceans in the overall climatic system, which has also escaped detection. My own view is that we are indeed witnessing the greenhouse warming, and that it will intensify in the next few decades. The East Anglian group cautiously come close to endorsing this view in their recent papers.

But we cannot yet rely in regional detail on the general circulation model results. Canada's own GCM has yet to yield detailed answers. Those from other centres broadly support the view that the primary effects of an increased greenhouse warming will be greatest in northern latitudes, and especially in fall and winter (in summer the thawing pack ice and cold Arctic waters restrict the effects). But these are major differences in detail.

A warming of up to 10° C in early winter is predicted, for example, by the Manabe-Stouffer analysis of 1980. But this model did not include cloud among the predicted parameters. A recent examination by Manabe and Wetherald (1986) allows cloudiness to vary as a predictand. Their results were applied by Hengeveld (1987) to Canada. For the warmer season — crucial in the Arctic for the ice regime and all economic activities. Figures 3 and 4 show predicted temperature rises and soil moisture changes for June – August for doubled CO_2. Clearly the major effect — and it is dramatic — is concentrated in central Canada. But a strong warming extends across the Arctic. Hengeveld warns that even this more sophisticated model has major deficiencies. We thus conclude that the best available models cannot yet predict conditions in the Canadian North with enough accuracy to satisfy those with operational responsibilities: but that they agree that a major warming is in sight.



Figures 3 and 4. Scenarios for doubled CO_2 climate (June, July, August) over Canada, as projected by GFDL, 1986.

What will this mean for the Canadian North? In this century the North has undergone radical economic invasions by southern industry, defence forces, and scientific research workers, with consequent disruption and challenge to its indigenous economies. These revolutionary decades have also seen major fluctuations of climate, on a variety of time-scales. I doubt if these fluctuations have much influenced the course of economic and cultural change. Nevertheless, Natives or immigrants alike, northerners must be capable of withstanding a uniquely high level of change from year to year. I recall, for example, that February, 1947, sent warm Atlantic air westwards across Labrador and Baffin Island, and that the pack-ice broke up everywhere south of the Davis Strait. Frobisher Bay — modern Iqaluit — saw a prolonged mid-winter thaw. On the other hand we all recall several years in which pack-ice in the Beaufort Sea, the Arctic Archipelago channels, Baffin Bay and the Davis and Hudson Straits never really loosened its hold through an entire shipping season. Yet the northern economy took it in its stride.

By comparison with these large year-to-year fluctuations, the greenhouse effect is expected to produce only slow changes. These will be most dramatic, however, in the latitudes of the Canadian Arctic. One model (that of Manabe and Stouffer 1980) indicates that a doubled greenhouse effect would raise fall and winter temperatures across arctic Canada by 6 to 10°C (in contrast to less than 2.5°C in southwestern Canada, and about 4-5°C in the south-east)[1]. This enhanced effect in the North arises in the models from the implied northward recession of the pack-ice limit and snow-cover on land, which darkens the absorbing surface to solar radiation, and hence raises temperatures further — a positive feedback.

In summer, however, the thawing pack-ice of the Arctic Ocean and surrounding seas and channels will hold temperature increases to much lower values. At least one modelling exercise — that of Parkinson and Kellogg (see Kellogg and Schware 1981) — finds that the Arctic Ocean pack-ice will disperse each summer if the greenhouse effect is doubled. The Manabe-Stouffer simulation, on the other hand, finds that summer dispersal of the arctic ice will require more than a doubling. A quadrupled

[1] These figures imply an annual warming in the Arctic of 0.1° to 0.2°C, as against the average for the earth of about 0.005°C for the past century.

effect clears the ice effectively. If this were to happen, the Arctic Ocean (whose permanent pack-ice has been there for a very long time, probably at least 750,000 years) would resemble modern Hudson Bay, whose pack-ice disperses in June and July, and forms again in the following fall and winter. There is thus the remarkable strategic prospect of being able to sail from Canadian harbours across the Arctic Ocean to Siberia and north European ports! At present only naval submarines venture this far under the permanent pack-ice shield.

What is the possible time-scale of these changes? The answer depends on various highly unpredictable quantities — the rate of future fossil fuel use, which in turn depends on manipulated prices; the future of the developing economies; the as-yet unknown future course of alternative energy and raw material sources; the equally unknown role of ocean absorption of atmospheric carbon dioxide; and on the future build-up of other greenhouse gases. None of these things can be specified with any confidence, certainly not from solely a Canadian base. Yet climatic estimates presuppose an answer.

At present rates of economic growth, a doubling of the greenhouse effect is conceivable by the third decade of the next century, and highly probable by mid-century. The recently accelerated world-wide warming may be part of this process. But it is most unlikely that the effect will be simply a gradual, continuous warming. In northern latitudes the effect will probably be of an increased frequency of mild winters and autumns, and of light sea ice conditions. There will still be unusually severe seasons in between. In the near future, as at present, the underlying upward trend of temperature will be obscured in the short-term by large anomalies. Moreover, past experience suggests that the effect will be spatially uneven; some areas will gain in warmth, while others do not — until the pendulum swings! The greenhouse warming is likely to be exasperatingly hard to pin down.

How will the Arctic be Affected?

Though the greenhouse warming will be slow and erratic beside the interannual differences to which we are accustomed, it would be a mistake to underestimate its potential impact. Its speed and magnitude will, if realized, exceed anything seen in post-glacial history, i.e., in the past ten millennia. Neither the Arctic ecosystems nor the Native peoples will have seen or felt anything like it (Hare 1981).

At sea, the thinning of the Arctic pack-ice, and the lessening of the fast ice and drifting floes that affect the channels of the Arctic archipelago, should lead to improved navigation conditions. The ice régime experienced in the most favorable recent years will gradually become the ordinary condition. This will also be true of the Beaufort Sea, Baffin Bay, Foxe Basin and Hudson Bay. I cannot put a reliable time-scale on this changed frequency of good sailing conditions; but it is quite likely to show itself within this century.

On the other hand any such shrinking and thinning of the northern sea-ice implies a major change in the habitat of marine mammals and fish populations. It also suggests altered hunting conditions for those who use the ice as a platform. On land it may also prompt substantial changes in vegetation and mammalian population, though any such change is likely to be slower than that of the climate itself. Changes in stream-flow, especially in the date and magnitude of the spring freshet, are also likely. The existing permafrost, already in disequilibrium in Alaska and (probably) the Mackenzie Delta, will be further disturbed.

Sea-level has been slowing rising world-wide — of the order 10-15 cm in the past century. This is very hard to measure. In the Arctic, and along the sub-Arctic fringe areas (especially Hudson Bay) the rise may have been masked or overridden by the rise of the land, due to the recent disappearance of the continental ice-sheets. This complication aside, it has been predicted that the greenhouse effect will accelerate the rise of sea-level to something between 25 and 140 cm per century (WMO-ICSU-UNEP, 1986). In the Canadian Arctic such a rise would have very serious consequences for the Mackenzie Delta, and more subtle but pervasive effects on shoreline ecosystems everywhere. More catastrophic rises of sea-level due to rapid disintegration of glacial ice, chiefly in West

Antarctica, are seen as unlikely in the next century.

Physical and biological changes on such scales are bound to have effects on human work and living places — especially in the North, where adjustment to habitat is often sophisticated yet fragile. I cannot begin to examine this in detail today, but I would urge all present to think of these effects, not as impending disasters, but as challenges to human ingenuity. The first priority is to get the science right, in order that the challenges can be specified.

How Should Canada Act?

One priority is defined: to get the science right. What else can be said?

First, that the emerging consensus on the greenhouse effect still leaves much room for error in detail; and that there is still the possibility that the world will make fools of the experts, by finding a way to absorb the added heat without such a dramatic effect on surface air temperatures. Given the enormous heat capacity of the oceans this possibility should always make us cautious in counselling action.

Second, that the changes, if they occur, are certain to be more complex and spatially uneven than is suggested in this paper. The details provided by the models are suspect, because of their simplified structure. Yet it is just these details that will matter most to those who will be coping with the changes.

Third, that it is not yet possible to give a clear, positive signal to governments, other than to be on the lookout, and to insist on the right research continuing.

And finally, to advise all those concerned with long-term strategic planning — foreign affairs officials, defence forces and corporations contemplating major long-term investments (such as harbour works, or hydro developments) and those who use the northern seas — to remember that change within the next fifty years is now a probability, not a possibility. The future will belong to those who see it coming.

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New Technologies in Studying and Managing the Taiga

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Introduction

The circumpolar coniferous forest, generally referred to as the *taiga*, is surprisingly poorly understood and has been of particular interest to only a small group of researchers. For thousands of years the area has been occupied by scattered human populations who understood and managed the taiga for survival. Western society's interest in this part of the globe began with the exploration of the fur seekers who sought to understand how furs could be produced economically. Periodically in the twentieth century certain industries, especially those oriented toward non-renewable resources, have looked to the vast taiga for exploitation of its resources. Industrial interests have resurged only when international economic conditions encourage the development of exceedingly large-scale operations. Many industries focussed largely on short-term management options.

In the past decade, there has been moderate industrial interest but other influencing factors, such as the growing aspirations of northern peoples for self-government, have increasingly had an impact on these northern landscapes. Groups are competing for control of various sections of the taiga zone and the land is being subdivided at a greater rate than ever before. An increasing number of industry-related leases are being issued. Government land management agencies are exercising control over large landscapes. For example, Parks Canada is claiming large sections to be designated as special conservation areas. Now more than ever before, Native land claim settlements are establishing even further boundaries around equally extensive areas. With control over large areas of land comes the harsh reality of the need for land stewardship approaches that prevent problems of the past being repeated and the need to assist the landowner in achieving the goals for a particular area. Generally there is a poor record of inventory for the newly-designated areas. Moreover, the natural dynamics of the resources are so poorly understood that even short-term planning, let alone long-term planning, can develop but slowly.

In this paper, I will provide some perspective of our current knowledge of the taiga landscape inventory, and the taiga ecosystem dynamics, including the effects of natural environmental influences. I will attempt to present a few examples to illustrate how geographic information systems and temporal and spatial models can be used to understand natural ecosystem dynamics. I will also try to demonstrate how these models can be applied to land management strategies so that particular goals can be reached. Since my background is that of an ecologist with specialization in botany and forestry, I will emphasize the natural dynamics and management of forested ecosystems.

Landscape Inventory

This immense geographic area known as the circumpolar taiga (total area, 14.7 million km^2 or 11% of the earth's terrestrial surface) extends in a band as wide as 1,000 km in some parts of Canada (Figure 1) and the U.S.S.R. Approxi

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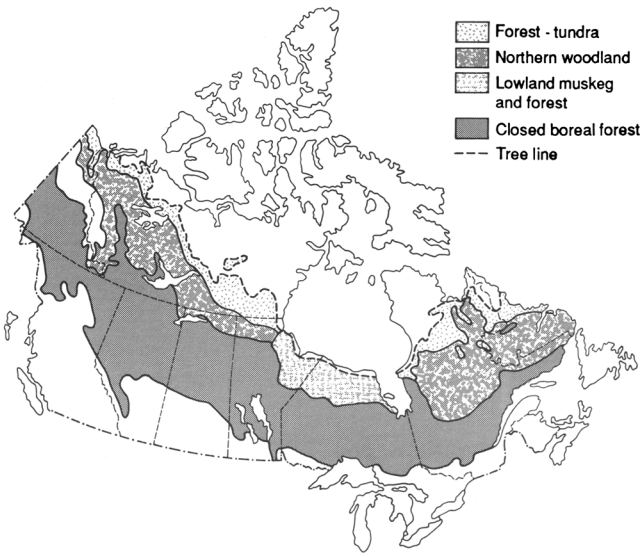

Figure 1. Taiga in Canada

mately two-thirds of the taiga stretches across the northern part of Eurasia and the remaining one-third across North America. Given the immensity of the area, the restricted number of scientists working in the North, and the fact that the available literature is being published in several languages, it is not surprising that the available information on taiga ecosystems has not been synthesized. I do not intend to ignore the excellent geographically oriented material or the more botanically-oriented studies documented by pioneer researchers such as Larsen (1980), Pruitt (1978) and Tamm (1976), but will point out that a co-ordinated international program has yet to be established that will encourage the development of such a synthesis. Should such co-operation develop, the use of technologies such as remote sensing by satellite imagery could easily be used to provide an overall inventory of this biome.

Satellites circle the globe at daily or weekly intervals, recording weather and other resource-related data, through measurements of reflected radiation from the earth's surface. By colour-coding areas with similar characteristics through computer-assisted techniques, hardcopy landscape maps can be drafted. The map units can then be correlated through field study to designate forests, aquatic systems, or other landscape features. Finally, by further field verification, and other traditional data-gathering techniques such as the use of aerial photography and ground surveys, these general landscape features can be further correlated with more specific features such as soil types or permafrost zones. Since remote sensing by satellite is conducted on a regular basis, researchers can compare digital data acquired at different periods of time. A wide range of change-detection techniques can now be used to detect changes brought about by drought, flood, or simply seasons. There is a large body of literature on this subject, but as an example, I will mention the work of Goward *et al.* (1985) and Tucker *et al.* (1986) who have used satellite weather information to examine vegetation patterns on a global scale.

Inventory data can be incorporated into map form as a permanent record but, increasingly, data are being used to form the basis for computerized geographic information systems. Several of these are well known: for example, in the 1970s, the Canada Land Information System was established as a nation-wide depository of landscape and natural resource information. In recent years, many smaller and less costly supporting software programs and microcomputer systems have become available, offering tremendous advantages over hardcopy reports, maps and aerial photography. Computerized GIS offers a cost-effective way of storing and retrieving large quantities of data using a uniform recording format; minimum training is required to use database management programs; more importantly, data can be easily corrected and information can be added or deleted at any time. Decreases in the cost of software and hardware have been so substantial in recent years that even small land holders find the systems economical.

Landscape Dynamics Over Time

One of the most important characteristics of northern biological systems is their stochasticity (i.e., randomness). The literature abounds with examples where wide population extremes, large population fluctuations or/and extremes in environmental conditions have affected

northern ecosystems. It is generally accepted that taiga forest ecosystems are heavily influenced by natural physical environmental factors that include climate (Hare and Ritchie 1972), permafrost (Brown 1970), and fire (Shcherbakov 1979, Wein and MacLean 1983). These researchers and others such as Van Cleve *et al.* (1986), Persson (1980), Wein *et al.* (1983), Johnson (1985), Karpov (1983) have examined the relationships between biological systems and the above physical factors. Generally, the literature has been descriptive but there are solid examples where generalized hypotheses have been tested experimentally with local examples.

Computerized technology is strongly influencing studies of landscape dynamics over time not only through more rapid statistical analysis of data but through the rapidly developing science of simulation ecology. These approaches borrowed from the physical sciences and engineering explore quantitatively interconnected relationships over time. The simulator is a simple analog of a complicated system. We are probably all aware of computer-controlled aircraft simulators that enable pilots to upgrade their training where the consequences of pilot error are minimal.

As yet, there are few unifying models which simulate the relationship between the physical and biological factors of taiga ecosystems. Bonan (1988) has attempted this by designing a model which simulates forest composition changes over time as driven by the major physical controlling parameters. These types of models will prove exceedingly useful in the future, because they can be used to extrapolate beyond data sets and to identify missing information. To a certain extent, the model can be used to guide research. More importantly, if the model is performing satisfactorily, parameters can be explored to provide the researcher with a greater understanding of ecosystem dynamics and to suggest alternate management strategies. Since model output can be checked against actual field conditions, the results of the modelling experimentation will frequently lead to the formation of new hypotheses.

Simulation models are not substitutes for experimentation in research but they are extremely useful to the scientific method as researchers attempt to examine major environmental issues such as the effect of climate change or environmental pollutants on taiga ecosystems.

Dynamics Over Time and Space

One basic management goal common to experienced and newer land-owners alike is to avoid surprises or problems that might arise from the lack of an ecosystem management program, or perhaps more importantly, the intervention of poor management strategies. Not only do ecosystems change over time, providing a temporal dimension to the problem, but frequently there is an important spatial dimension that must be considered as well. For example, wildlife managers are frequently attempting various strategies (e.g., predator control, habitat protection, etc.) in an effort to control, or even avoid rapid declines in localized wildlife populations. On a more regional or national scale, populations are often not synchronized in various geographic areas. Thus, to fully appreciate the ecological status of a taiga species, it is necessary to examine the important interactions between the temporal and spatial dimensions.

The same general approach could be applied to the management of plant species populations. For example, a forest fibre industry company requires a predictable long-term supply of wood resources. The landscape under control would be populated with different-aged tree stands with different rates of growth and management strategies would necessarily account for the spatial element in the prediction of fibre yield over time. Managers would also have to account for losses of fibre to such natural phenomena as fire and insect damage, factors which are also time and space-dependent. Therefore, temporal and spatial considerations are important to the development of management strategies.

There is now a growing body of literature that deals with landscape-level ecological processes and decision support systems that can assist with strategy development for the management of resources. Most of these studies have been made

possible by advanced computer techniques that enable researchers to quickly store and retrieve large quantities of data, calculate new values, and present the results to the manager so that better informed decisions can be made more quickly.

Management Goals

An ecologist may be interested in understanding ecosystem dynamics and how environments can change over time and space. A land manager, however, must also work to establish management goals for specific units of the landscape. As examples, a forest fibre company may have the general goal of maximizing fibre yield through minimizing fibre loss in all areas of the landscape. The manager of a national park might wish to ensure that regular environmental forces are allowed to continue without intervention so that natural ecosystems will be perpetuated.

These goals are very general, but for temporal and spatial landscape models to be most useful to the manager, goals must be developed for a specific landscape unit or grouping of units. For instance, the manager must determine whether or not the landscape unit is to be protected from such forces as fire or insect attack. Perhaps it will be decided that a certain forest unit should be maintained in an early stage of succession in order to provide a suitable habitat for a particular animal, plant or bird species. Perhaps fire or insect attack must be eliminated.

Once a decision has been made regarding a particular land unit, time and space landscape models can be used to explore a range of strategies that once implemented, would lead to the goal. For instance, the model could be run using several fire frequencies to determine which frequency would provide the ideal habitat for the conservation of a species.

A Case Study in Wood Buffalo National Park

The setting and the goals

Parks Canada, a major land holder, administers some 85,000 km^2 of landscapes in the taiga zone. One of these landscapes, Wood Buffalo National Park, is the largest forested national park in the world, and at 44,800 km^2 it is larger than the country of Switzerland. The park stretches almost 300 km north to south, reaching 60° 32' N latitude. Most of the park is characterized by undulating relief between 200 m and 300 m elevation, but the Caribou Mountains to the west and the Birch Mountains to the south rise to maximum elevations of approximately 1,000 m and 800 m, respectively.

Due to budget restrictions and lack of personnel, in past years, management strategies were primarily crisis-oriented. As cost-saving measures, activities such as fire fighting were often mounted in synchrony with other organizations operating outside of park boundaries. More recently, Parks Canada (1983) recognized the need for more effective land management programs, as they are more aware of the natural role of disturbance in forest ecosystem dynamics. From this awareness stems the recognized need for research to understand how natural disturbances can be incorporated into sound landscape management practices to achieve stated goals. These concerns are common to conservation managers in most circumpolar countries (Lotan *et al.* 1985).

Our research team at the University of New Brunswick Fire Science Centre was invited to undertake a research program in Wood Buffalo National Park to examine the feasibility of using dynamic geographic information systems to develop natural resource and fire management programs for the area. We were approached to conduct this study because between the years 1979 and 1981, approximately 20% of the park vegetation was burned. There were not only concerns for the safety of park visitors, but also for the trapping economy that is based on the park landscapes. It was also recognized that the quantity of fuel removed as a result of these fires was so significant that a management program would be more successfully implemented soon after the fire than in later years as fuel quantities build to higher levels.

Inventory

As we initiated the research, our first requirement was for an inventory of the Park's

ecosystems. The most detailed spatial information at our disposal was a resource survey conducted in the 1970s (Airphoto Analysis Associates 1979). We were fortunate in that this survey information was already available in digital form and therefore was easily integrated into our database program. It was possible to make the data set available to managers through desktop microcomputers that are located in Parks headquarters (Wein *et al.* 1987), and the data were also made available to researchers for modelling programs. Although this information was extremely useful to gain perspective of general forest composition, it was not sufficiently detailed for landscape ecosystem models. In addition, much of the information provided in the 1970 survey is outdated because fires in the late 1970s and early 1980s changed the vegetation dramatically. In order to further our studies, satellite imagery data (Landsat [MSS]) was obtained and analyzed for two 30 km x 30 km study areas. Once the digital data were analyzed and landscape units identified according to signals, hardcopy maps were produced, taken to the field and verified for accuracy. It was found that most of the major vegetation types could be readily identified (Morin *et al.* 1988), and a database was developed with a resolution of approximately 30 m x 30 m.

Parks personnel can modify the database by correcting and adding information as it is obtained from future studies. Also, a great deal more spatial information is available from the map library at Wood Buffalo National Park. As this information is added, the database will become increasingly useful over time. The landscape information will be current, provided the database is updated regularly, and much more accessible than hardcopy formats. Parks personnel recognize that the availability of such information will help to ensure more informed decisions, particularly for newly-appointed personnel who might not be familiar with remote areas of the Park or the history of the Park's ecosystem.

Temporal models

Two types of temporal simulation models were developed for our study. The first involved a long-term forest dynamics model that can be used to explore forest composition changes over decades (Wein and El-Bayoumi 1985). The second model was developed to simulate the rate of change of fire behaviour over time (Feunekes and Methven 1988).

The long-term forest dynamics model (based on models described by Shugart 1984) essentially simulated forest composition change from observations of the growth of competing trees as influenced by such factors as climate, which directly control growth, and stochastic factors such as fire, which impacts on individual trees or all trees in a landscape unit. The model was calibrated with forest composition and tree growth data taken in the park and verified by independent sets of data. Once this verification process was completed, the model was used to examine the natural dynamics of vegetation. For instance, although it is well-known that fire frequency and characteristics of fire behaviour will change forest composition, the model permitted a detailed exploration of these factors which influence forest composition.

The use of the long-term forest dynamics model has proven an efficient technique. The alternative approach would be to sample a large number of field sites and then categorize these field sites according to succession patterns. This approach would require a large investment of time and money for field surveys. It would also be difficult to find the full range of different-aged stands to complete the forest succession series because large fires have swept through the park at irregular intervals.

The model has also permitted us to explore specific hypotheses such as why certain forest compositions are found in some areas of the park. For instance, it was suspected that burning around settlements in the past has led to the formation of stands dominated by a single tree species, *Populus tremuloides* (trembling aspen). An exploration with the model has shown that repeated fires will remove all trees except this species. We now suggest that repeated fires caused by former residents of the Park and prior to fire suppression enforcement in the Park led to this species dominance.

The fire behaviour model is based on well-

established relationships between fire behaviour and fuel characteristics as described in the Canadian forest fire behaviour prediction system (Lawson *et al.* 1985) and the Canadian forest fire weather index system (Van Wagner and Pickett 1985). The relationships have been well tested so the model will predict, with a high degree of probability, the rate of spread of the fire and rate of energy release. This type of prediction is exceedingly useful to fire managers who must organize personnel and equipment when suppressing unwanted fires and is already being used in the day-to-day fire management program.

Temporal and spatial models

The temporal long-term forest dynamics model and the fire growth model have been linked to spatial data banks to achieve other goals in our research program.

The forest dynamics models have been integrated into the geographic information system described by Jacobs *et al.* (1988) that contains forest composition data sets. By using this information as input into the temporal model, it is possible to predict the forest composition for areas on the landscape in 5, 25, 50 or 100 years. This work could be especially useful in predicting changes in animal populations, provided animal populations can be correlated to stages of forest succession.

This approach would enable researchers and managers to answer questions such as "What are the predicted population changes for a given number of adjacent landscape units, if a total fire exclusion policy is practised for the next 50 years?" If the model output does not meet the goals established for that area, then the fire suppression policy should be modified. A similar approach could be used to develop a greater understanding of the quantity of fuel and distribution of specific fuel types over the landscape, given the same type of fire suppression scenario.

The fire growth model described by Feunekes and Methven (1988) not only simulates fire behaviour within a fuel type but is programmed to simulate fire spread across the landscape in 100 m x 100 m cells. These cells are categorized into 14 well-recognized fuel types and the model simulates the movement of fire from one cell to another in an elliptical pattern.

This temporal-spatial model represents an exceedingly important decision support system for a parks fire manager. When a fire is located through aerial or fire tower surveillance and the specific location verified, the fuel data bank stored in the geographic information system can be retrieved and used along with prevailing weather conditions as input to the model. The fire growth model can then be used to predict the path and rate of spread of the fire. Further predictions can be made by inputting the weather forecast for subsequent days.

The fire manager can utilize this information to determine whether a fire should be suppressed or be permitted to burn. The decision will depend not only on the danger to people and property, but also on the ecological goals that had been established for the landscape units in the path of the fire.

Conclusions

To date, only relatively small areas of the vast geographical area known as the taiga have been inventoried, even though modern technological methods such as remote sensing are available to accomplish this on a larger scale. Even less is known about the dynamics of these ecosystems because few intensive studies have been carried out. A large percentage of the taiga is still in pristine condition, making the area attractive to ecologists and other researchers who wish to understand how natural ecosystems function and how they respond to such major environmental problems such as pollution, radioactive fallout and pesticides, or major changes such as those proposed by climate change scenarios. To date, these taiga landscapes have not been managed extensively for resource extraction or other activities.

Management necessitates a resource inventory and predictions of how resources change over time and space so that management strategies can be implemented and goals can be reached. Computer and other technologies are playing a prominent role in this landscape science. The information currently at our

disposal can be organized into standard format computer databases, making the data readily available to researchers and land managers. Fortunately, such models as the temporal forest dynamics models are now becoming available so that a generalized understanding of ecosystem responses to natural disturbances and other environmental influences is possible. From results of experimental studies and computer modelling, land management strategies can be developed to achieve goals for particular landscape units. It is anticipated that computerized technology will prove useful since it is readily available and a reasonable investment, not only for large land-holding agencies such as governments, but also small landowners with limited management resources such as Native groups who have received land in settlement claims.

Acknowledgements

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Effects of Technology and Economics on the Foraging Behaviour of Modern Hunter-Gatherer Societies

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The notion that the purpose of science is to learn about nature with the specific intent of manipulating it to achieve goals based upon human values has permeated most published definitions of wildlife management. Leopold (1933) viewed management as "the art of making land produce sustained annual crops of wild game," and most textbooks about wildlife management since have reiterated this definition (Giles 1978, Bailey 1984, Robinson and Bolen 1984, Anderson 1985), thus perpetuating the idea that the purpose of science is to subdue nature for the well-being of humans. Research pursued in that vein is referred to as "applied," "mission-oriented" or "targeted," and in the area of wildlife management, its goals can be influenced more by socio-economic and/or political concerns than by biological concerns. Scientists pursuing "basic" research on the other hand, try simply to answer questions about how nature works; neither the questions they ask, nor the organisms they select to address them, need be influenced by socio-economic or political considerations.

Though in retrospect it may seem surprising, the histories of the sciences of basic ecology and wildlife biology, with few exceptions, developed along different paths until recently. Wildlife science has been, by and large, conducted with the goal (implicit or explicit) of understanding how to manipulate wildlife to achieve sustainable yields. Basic ecological research, on the other hand, pursued questions about why populations fluctuate. While the former field of investigation tended toward development of empirical relationships, with attendant expertise in data acquisition, the latter more often pursued the development of theory and explanation. Each field, however, tended to lack requisites for making satisfying advances towards their respective goals; some wildlife scientists lacked conceptual frameworks for effective interpretation of data or adequate testing of management practices (see Romesburg 1981, McNab 1983) and some ecologists developed theories wanting for empirical tests (see Fretwell 1972, Nudds 1979).

Recently and increasingly, many concepts and areas of investigation relegated to the field of "basic ecology" are being integrated and applied to the management and conservation of renewable resources (e.g., May et al. 1979, Soule and Wilcox 1980, Soule 1986). The purpose of this paper is to explore how syntheses of ecology (specifically optimal foraging theory) and anthropology (e.g., Winterhalder and Smith 1981, Belovsky 1987 and many others) might help wildlife scientists evaluate changes in the way modern humans in hunter-gatherer societies interact with renewable resources that they harvest.

Beginning with the premise that "the purpose of science is not to conquer the land, but to understand the mechanisms of ecosystems and to fit [humans] into the resources ... available..." (Hickey 1974), I proferred the argument elsewhere (Nudds 1986) that humans (whether for recreational, subsistence, or commercial purposes) share similarities with other predators in the manner in which they exploit prey. I argued,

therefore, that humans might profit by understanding the characteristics of systems where predators harvest resources as if prudently managing them on a sustainable-yield basis. Here, I extend that argument to indicate how human and non-human predator-prey systems share similarities in the manner in which ecological and energetic factors can favour over-exploitation rather than prudent resource management. Furthermore, I will argue that the economics of human societies which substitute dollars for calories as the currency of predator-prey interactions, can additionally favour over-exploitation. These ideas, particularly with regard to the Canadian North, are not new (see, for example, Theberge 1981), but I hope to demonstrate here that merging concepts from fields as diverse as foraging ecology, anthropology and resource economics may help to resolve conflicts about how to manage human predator-prey systems to ensure coexistence.

Density-Dependence and Population Growth in Humans and Other Predators

Merging concepts from diverse fields of study will invariably involve a merging of the languages of researchers in each field. Sometimes this can contribute to confusion, misunderstanding, and perhaps incorrect conclusions. For example, there exists considerable confusion about whether human and non-human predators voluntarily adjust natality rates to reflect prevailing conditions of food abundance. Many anthropologists agree that human population size, and other attributes like family size and body size, were historically determined principally by the amount, and temporal and spatial distribution, of food supplies (Crowe 1974, Belovsky 1987). Theberge (1981), a population ecologist, argued that "population limits [of humans] were established by the immediate environment, no different in that regard from the populations of all other species ... of northern ecosystems." He continued: "No longer are the limits to either human populations or to human activities in the North established directly, through immediate ecological factors...." Finally, he wrote: "Anthropologists have not described any behavioural self-regulatory mechanism or tradition to adjust natality to ... food supply, such as exists in man's co-predator, the wolf." However, Feit (1984), an anthropologist, argued that Theberge's claim "that there are no behavioural self-regulatory mechanisms ... to limit human natality with respect to food supply, or to conserve resources, is simply wrong on both counts," and cited an abundant anthropological literature on the limitations to growth of hunter-gatherer populations. Feit claimed that, because some humans in the boreal forest harvest some renewable resources within territories on a "rotational" basis, humans show evidence of behavioural self-regulation enforced by "ethnophilosophies" against over harvest and waste (see also Berkes 1981). However, despite evidence of this type of "self-regulation" of harvests of renewable resources, humans have nevertheless experienced "rapid population growth" (Feit 1984, see also Kemper 1980, Fuller and Hubert 1981) and there is documented evidence of wastage (e.g., Riewe and Gamble 1986). Part of the problem is that the term "self-regulation" has implied very different things to population ecologists and anthropologists, and discussants of the subject have argued at cross-purposes with one another as a result. Particularly confusing are the contradictory claims that human populations, at the same time, can be both "self-regulated" and growing rapidly!

Such confusion is, however, understandable given the history of the debate about the concept of population "self-regulation" that occurred among ecologists. Both Theberge (1981) and Feit (1984) adopted the notion of "self-regulatory" mechanisms that adjust natality to food supplies. On this point, both are incorrect. Most ecologists now reject the idea of such behaviour because it would require group selection to evolve and be maintained in a population; such behaviour, then, could not persist in a population (Trivers 1985). After several years of argument among ecologists about the relative importance of extrinsic (environmental) vs. intrinsic ("self") regulatory agents in natural populations, as if only one or the other was important, a new view emerged which assigned hierarchical importance to the mechanisms proposed to regulate

population size. An important conceptual feature of this synthesis was the realization that "self-regulatory" mechanisms were still directed to an end that entailed maximizing reproductive output, within the constraints that environmental factors (e.g., food supply) ultimately placed on population size by influencing natality (and mortality) rates. These environmental factors, however, could be mediated proximately by intrinsic factors (e.g., behaviour or reproductive physiology). In this view, behavioural "regulatory" mechanisms sometimes can act to limit natality, but always act to maximize surviving offspring. Ultimately, then, relative resource levels regulate population size. An important corollary of this idea is that reproduction by all organisms proceeds at a maximal rate (e.g., McNab 1980), constrained by the availability and variability of requisites for reproduction in the environment. Importantly, when organisms, like humans, are freed from environmental constraints on natality, natality increases and populations grow.

In other respects, these authors are less in conflict than first appears. For example, each apparently had in mind his/her own experiences with different groups of "northern peoples." Because the Canadian North encompasses territory with a wide variety of terrestrial and aquatic environments, "northern peoples" encompasses humans with a wide variety of lifestyles. Some northern peoples inhabit environments with fluctuating, unpredictable resources; perhaps a "conservation ethic" did not evolve (Theberge 1981) because natural selection favoured opportunistic harvesting of prey. Among other northern peoples (Feit 1984) that inhabit environments with more predictable fluctuations in prey abundance, it may well be that selection favoured a "conservation ethic" and a rudimentary form of wildlife management with a goal to sustainable harvests. Importantly, though, neither humans nor other predators, appear to limit natality "voluntarily." If predators do harvest prey on a sustainable-yield basis (i.e., with a "conservation ethic") it is *because* such behaviour has enhanced reproductive success, not limited it.

Simple Models of Predator-Prey Population Dynamics and the Goal of Renewable Resources Management

In species where they exist, then, behavioural "self-regulatory" mechanisms are merely a proximate manifestation of the ultimate influence that environmental factors have on natality and mortality rates. Factors that decrease natality rates (or increase mortality rates) as population size increases are said to operate in a density-dependent manner. Ecologists have developed simple mathematical models that mimic the dynamics of predator populations that are regulated in such a manner by the abundance of their prey (Figure 1). The models indicate that predator and prey populations should oscillate continually and slightly out of phase with each other because of density-dependent population regulation. Simply, a predator population grows to the limit that the size and availability of the prey population can support. At that point, either the predator "overharvests" the prey, or the rate of growth of the prey population begins to slow because it itself is regulated in a density-dependent manner by the levels of its own food. Regardless, the prey population declines and the predator population follows. When predator populations are low, prey populations grow. Then the predator populations can grow again, and the cycle continues. Though over-simplified, this model captures the essence of density-dependent regulation of predator populations.

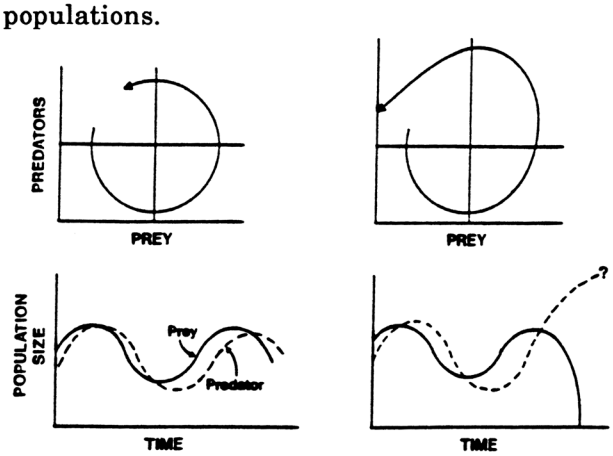

Figure 1. Stable and Unstable Cycles in the Abundance of Predators and Their Prey

This same model can be used to explore the consequences of decoupling the limits to the growth of predator populations that are imposed by the availability of prey populations (Figure 1). When predators can exist on alternative resources, for example, their density is no longer dependent on the density of one prey. If the predator population grows large, it may continue to exert pressure on that prey. In this case, the prey may not recover, and the dynamic equilibrium of predator and prey populations is disrupted. In the end, prey may, for all intents and purposes, go to extinction; predators must then subsist wholly on the alternative resources, or go to extinction also.

The objective of sustainable yield management of renewable resources is simply to mimic the former case of predator-prey dynamics and avoid the latter. It is the job of the wildlife scientist, for instance, to analyze and identify the factors in user-resource systems that, ecologically, have the same effect as decoupling the size of predator populations from the limits imposed by the size or availability of their prey populations — particularly those agents that could lead to overexploitation of resources for reasons not readily apparent to the users. Having identified such factors, the wildlife manager must attempt to mitigate their effects, so as to either restore a sustainable yield harvest of resources by users, or prevent the decoupling of the interaction between users and resources in the first place. In some respects, it is the manager's job, rather than the scientist's, that is the more difficult of the two. Although it is hard enough for a good scientist to try to operate outside the constraints of his own political and sociological persuasions to conduct some objective analyses of a problem, it is the manager who has to argue the validity of any conclusions so drawn, often to other scientists and managers of diametrically opposed political and sociological persuasions. The controversy about subsistence harvests by Canadian northern peoples is no exception.

In the next section I examine, with the use of a simple foraging model, one factor that can lead to overexploitation of resources by users. The model shows, and is consistent with empirical evidence, that when the foraging costs of predators are low (i.e., when hunting costs are subsidized), it makes sound economic sense (even when the "currency" involved is just the energetic costs and benefits of foraging), for predators to kill more prey than they require for sustenance and not to consume some of it.

Foraging Theory and the Economics of Prey "Waste"

Wildlife biologists and anthropologists have long studied how humans and other animals feed. Only relatively recently, however, have foraging theories been used to evaluate foraging behaviour. A considerable literature about the concept of optimality and decision-making in foraging behaviour has developed — particularly for non-humans (see Pyke et al. 1977, Pyke 1984, Krebs 1978, Lacher et al. 1982, McNair 1983 for reviews). More recently, anthropologists have used optimal foraging theories as a basis for investigating human foraging behaviour (e.g., Winterhalder and Smith 1981). Biologists have also published in anthropological outlets (e.g., Belovsky 1987 and others cited therein). A comparison of human and non-human foraging behaviours, contrasted with predictions from several models, demonstrate parallels in the ways that humans and other predators harvest renewable resources (Nudds 1986). These comparisons suggest strongly that humans might learn much by using these models to evaluate the consequences of various management scenarios on human user-resource systems.

One foraging theory provides an explanation for the observation that humans (Theberge 1981, Riewe and Gamble 1986) and other predators (e.g., Pimlott et al. 1969, Carbyn 1983, Oksanen et al. 1985) sometimes kill more prey than they consume. In the language of wildlife biologists, such behaviour has been called "wanton killing," "surplus killing," or "excessive killing"; theoretical ecologists have called it "partial prey consumption."

A basic tenet of evolutionary biology is that natural selection favours individuals that maximize their inclusive fitness. Ecologists frequently use reproductive output as a measure of fitness. Reproductive output is maximized

when organisms can convert resources acquired from their environments into surviving offspring (see Moen 1973). Optimal foraging theories propose that animals maximize their fitness by optimizing their foraging activities so as to acquire the greatest net resource (usually energy) gain; that is, they forage with the goal of acquiring the greatest amount of energy with the least amount of energy expense.

Sih (1980) stated it quantitatively: the goal of foragers is to maximize the net energy gain per unit time spent foraging (E_n). Foraging involves energetic costs of two types, however: predators spend time (t) and calories (c) both searching for prey (t_s and c_s) and handling (killing and consuming) prey (t_h and c_h). Typically, once a prey is caught, predators consume the parts that are easiest to consume and provide the greatest nutrition. Lions and wolves, for example, frequently eat organs before they eat muscle and hides. Thus, the predator consumes energy while eating prey (c), at a rate that decreases, even though total energy intake increases. Thus,

$$E_n = \frac{cT - c_h t_h - c_s t_s}{T + t_h + t_s}$$

where T is the time spent consuming a particular prey item, c is the calories consumed by the predator, c_h and c_s are, respectively, the caloric costs of handling and searching for prey and t_h and t_s are the amounts of time spent handling and searching for prey.

The equation can be solved to find the optimal amount of time a predator should spend consuming a prey item (T), given the costs of looking for other prey; however, for the purposes of this paper, a simple graphical solution suffices (Figure 2). When the costs of searching for prey are low, the model predicts that predators should not consume a given prey item completely. This is because, in the time it would take it to eat the less nutritious parts of that prey, the predator could reasonably expect to find, pursue and capture another prey and consume only the best parts of it. By doing so, the predator gains more than it loses. On the other hand, if prey are harder to find, then the predator benefits more by completely consuming each prey item it manages to catch.

Prey may appear to be abundant or scarce for several reasons. First, prey abundance itself can

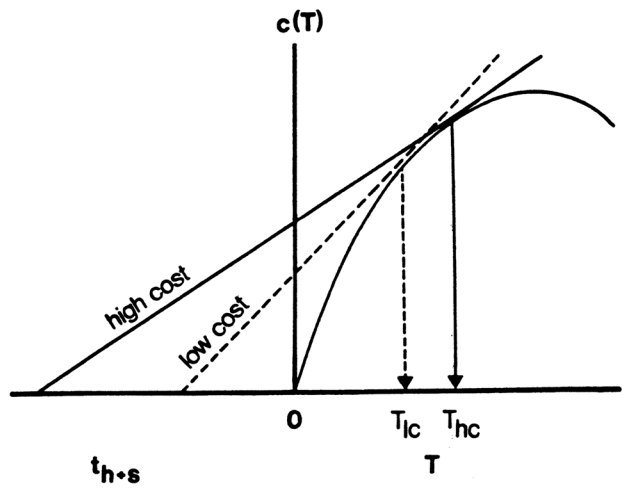

Figure 2. Costs of Searching for Prey and Time Spent in Its Consumption

change. Second, predator density can change relative to prey density; hence, prey may be *relatively* more or less abundant, even if no absolute changes in prey numbers occur. Finally, if for some reason it becomes much easier for predators to find and kill prey (i.e., capture success increases), then even if absolute predator and prey densities don't change at all, predators perceive the abundance of prey to be relatively higher. Under such conditions, Sih's (1980) model predicts that predators will partially consume prey and "waste" the rest. (Interestingly, "waste," as used in this case, is not as humans normally assign a negative connotation to the word. It is difficult to reconcile our cultural understanding of "waste" with that which results from an energetics model which suggests that "wasting" is one strategy by which predators can actually enhance, rather than impair, reproduction!)

Among both human and non-human predator-prey systems, there are examples of prey "waste" under exactly these ecological conditions (i.e., high relative prey abundance made so by easier hunting conditions). For example, Pimlott et al. (1969) showed that wolves consumed more of each deer that they caught in mild winters when deer were hard to catch than they consumed of each deer they caught in severe winters when deer were easier to catch.

Similarly, Carbyn (1983) observed that, within years, as winter progresses and conditions generally worsen, prey are easier to catch. Wolves do not consume each elk that they kill late in winter as completely as they do in early winter. When horses from the Old World became part of the harvesting tradition and technology of Plains Indians, buffalo could be killed by driving them to slaughter in large numbers. Archaeological evidence indicates that the least nutritional parts of prey slaughtered in this manner were discarded (Speth 1983). Later, non-Indians also slaughtered buffalo indiscriminately and consumed little of each. From all of these examples, a pattern emerges: when the foraging costs of predators are low (that is, when foraging is easier for whatever reason), a simple analysis of foraging energetics predicts that predators should not consume completely each prey. With the advent of firearms and motorized transportation in the North, technology similarly has lowered the energetic foraging costs of humans. For example, once the harpoon-lance-float technique was used to kill whales, and the methodology was too energetically expensive to waste the prey. Now rifles and motorboats have been substituted and modern hunting has resulted in killed-but-lost rates up to 70-80% (Kemper 1980).

Economics of Overexploitation

Suppose now that prey have value for the predator by providing other than immediate sustenance. Assume that for the predator involved, even non-nutritional parts of prey, like fur or ivory, have some value imposed by an economic infrastructure that uses dollars as currency, rather than calories (see Fuller and Hubert 1981). An incentive for killing narwhal in recent years, for example, has been the value of the tusk (Kemper 1980).

The imposition of such economic systems on humans that hunt in the North, in addition to those imposed by the economics of foraging energetics, results in a situation that can effectively select against a "conservation ethic" for two reasons. First, because the energetic costs of foraging are effectively "subsidized" by technology originating external to the user-resource system, the size of the population of human predators is no longer regulated in a state of dynamic equilibrium with available prey (Figure 1). Hence, density-dependent feedback mechanisms that suppress predator natality do not operate. The predator population, in this case, can subsist on alternative resources, some acquired with currency generated from the sale of parts of prey, while continuing to grow and kill with less effort. Even if per capita rates of prey harvest did not increase with time, an increase in the absolute numbers of predators killing at the same rate means that prey populations may not have the opportunity to recover from harvest to low levels (Figure 1). The result is that the objective of sustainable yield harvests will not be met.

Second, as Clark (1973) has pointed out, economics and a "conservation ethic" are often incompatible. The present value of a sum of money (PV) invested at an interest rate (r) grows to a future value (FV_n) after some time units (n) according to:

$$FV_n = PV\,(1 + r)^n.$$

Rearranging, the present value of a sum of money in time units from the present is given by:

$$PV = \frac{FV_n}{(1 + r)^n}$$

where r is now referred to as the "discount rate." Resource economists, evaluating renewable resources in terms of dollars, refer to the "discounted present value" of the resource when considering the question: When, economically speaking, is the best time to harvest a renewable resource and convert the tissue to cash? The answer, generally speaking, is: Whenever the interest rate at the bank is greater than the growth rate of the renewable resource. This is because the value of the resource grows more quickly as cash than as tissue. The longer resources remain unharvested, the greater become the missed opportunities to gain economic wealth (Figure 3). Clark (1973) analyzed how the effects of discounted future earnings effectively led to the overexploitation of whales during the past several decades. Similar economic forces are a potential threat to resource conservation wherever humans harvest prey for economic gain, and are not unique to Canada's northern peoples.

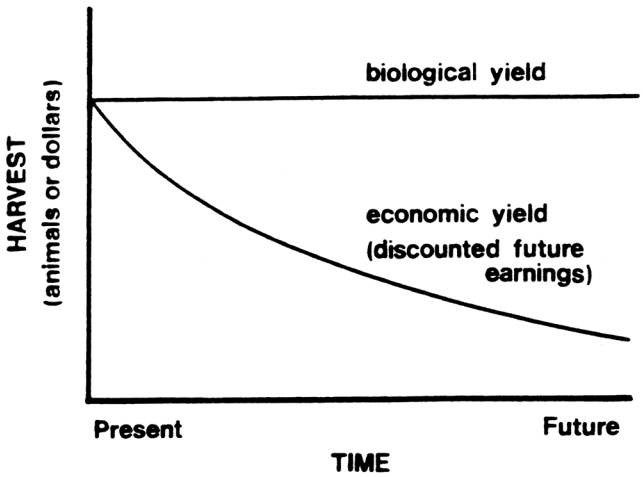

Figure 3. Animal Harvest and Numbers/Value Over Time

Implications for "Traditional, Subsistence" Harvests

Understandably, the maintenance of lifestyles incorporating harvests of wild, living resources is a stated goal of northern peoples. There are, however, differences of opinion as to the best way to achieve that goal. Traditional, subsistence foraging was understood once, at least implicitly, to refer to the harvest of wildlife without the use of modern technology and for the purpose of obtaining resources for consumption. A closer investigation of the meanings of "traditional" and "subsistence" harvesting is, however, problematical. First, "traditional" refers to that knowledge that is part of a people's culture passed on from generation to generation (Landau 1974); there is nothing in the definition of traditional that implies that habits need be "archaic" (like hunting techniques used by indigenous northern peoples prior to European contact). Thus, northern cultures and traditions have evolved, and incorporated technology and economics. On the other hand, "subsistence" refers to managing to live in an unchanged fashion (Landau 1974), so "traditional subsistence" is a contradiction in terms.

Of greater substance than niggling about definitions, however, is what lessons we might take from the foregoing discussions of foraging ecology and economics and what these may mean with regard to prospects for the future of hunting lifestyles of northern peoples, particularly when contrasted against statements that indicate the direction of policies about the rights of human predators to harvests of those resources. Penner (1978), for example, writing in his role as a special envoy for the then Indian and Northern Affairs Minister, the Hon. Hugh Faulkner, said: "The Government is ready to discuss the needs of the Native people as they relate to game and harvesting rights.... Consideration will also be given to ... those who wish to pursue the *traditional* [used wrongly] way of life, either on a full- or *part-time basis*, and to do so with a greater degree of *economic* security..." (my emphasis and brackets). The Department of Fisheries and Oceans (Anon. 1985), in responding to a request to stop hunting of narwhals, said "... in recognizing the needs of Natives, a strict definition of *subsistence* has been implied; a definition which does not apply today. The Inuit peoples have been removed from their *traditional* [used wrongly] way of life and ... they must now rely on the Cooperatives and the Hudson's Bay Company for certain basic necessities which require *'hard cash'*. For most Native people, the only reliable source of income to support their *'subsistence'* is ... the natural renewable resource and the *income* they provide" (my emphasis and brackets). Government agencies and organizations of northern peoples should give careful consideration to the economic and, hence, ecological consequences of explicitly adopting policies that recognize that subsistence harvest no longer means that harvest which supports just sustenance, but also the accumulation of material wealth. As the analyses in this paper indicate, that same policy could well do more to undermine attempts by northern peoples to achieve the goal of lifestyles that incorporate sustainable harvests of wildlife, than to aid them to attain that goal.

Evolution of a Pluralistic Culture Witnessed in Art and Hunting Practice

For ecological and economic reasons alone, a principal feature of any ensuing integration of tradition and technology in the North (as the title of this symposium presupposes) would appear to be the imposition of legislated use of renewable

resources. In the context of the arguments I have raised, the function of these regulations should be viewed as simply biological. In effect, they should function to "intrinsically" regulate the harvests of renewable resources by human predators that were most probably once "regulated" extrinsically by the density-dependent feedback effects of relative resource shortages. The advent of new technology and economic infrastructures in the North have given northern peoples both the ability, and the incentive, to override extrinsic regulatory factors.

A major bone of contention, however, and one about which there has been a lot of discussion in the socio-political arena, is the issue of *whose* rules about wildlife harvests will apply in the North. On the one hand, as part of the rhetoric about self-determination for northerners, is the argument that northerners have had the ability to overharvest wildlife since even before contact with European technology, but didn't because of self-regulating "ethno-philosophies" which dictated against prey waste (see above). It is argued that harvests by humans were historically restrained, rather than constrained, and that northerners manage wildlife for "subsistence" purposes by much the same rules today. On the other hand, and equally wrong, are those who would argue that northerners are incapable of self-regulatory wildlife harvesting practices.

Those who argue that ethno-philosophies against overexploitation exist today much as they did before European contact, also argue that ethno-philosophies work as deterrents. It is clear, however, from the documented instances of overharvest that, from time to time, they do not (Riewe and Gamble 1986). I do not, then, disagree with those who argue that it was the intrusion of elements of southern culture into northern culture that caused "breakdowns" in self-regulatory behaviour. I do, however, disagree with those who imply that ethno-philosophies about wildlife harvests have not evolved and, further, are sufficient social deterrents against overharvest today.

It is my purpose in this section to critically examine the contention that somehow, despite years of evolution to a pluralistic culture, as witnessed by analogous changes in art and language (e.g., Graburn 1986), northern peoples have somehow managed to stave off similar intrusions of philosophy about wildlife harvests from other cultures. I will show, rather, by comparison with a model for the evolution of tourist arts, that there is also good reason to expect analogous evolution of ethno-philosophies regarding wildlife harvests.

In Figure 4A, I have reproduced Nelson Graburn's (1984) model for the evolution of tourist arts, which he recently illustrated specifically with examples from Inuit culture (Graburn 1988). In Figure 4B is an analogous model for how ethno-philosophies about wildlife harvests can be similarly viewed. Once, like the place art held in religion, ethno-philosophies that dictated against overharvest and prey waste had a functional place in the hunting culture of northern peoples and no doubt promoted sustained harvests of wildlife for sustenance. Although, ultimately, resource levels probably constrained population size of human predators, selection may have proximately favoured restrained foraging behaviour (reinforced by cultural taboos and so forth), particularly if the selective advantage lay in the fact that the group of predators could achieve some goal like sustained resource harvest (and, hence, a net increase in evolutionary fitness).

With the advent of new killing and transportation technology in the North, came new pressures on ethno-philosophies about overharvest, culminating in recent times in wildlife harvests, not just for sustenance, but also for "subsistence" (i.e., to meet the economic costs of new standards of living in the North). From time to time, overharvest has occurred (Riewe and Gamble 1986, Kemper 1980). Recently, however, constraints imposed by elders on younger hunters, and peer pressure among hunters, have been used to curtail wasteful wildlife killing (Riewe and Gamble 1986). These amount to a re-integration of historical disincentives for overharvest into a changed northern culture; similar stages occurred in the evolution of art (Figure 4). In the extreme, like art which evolved into souvenir

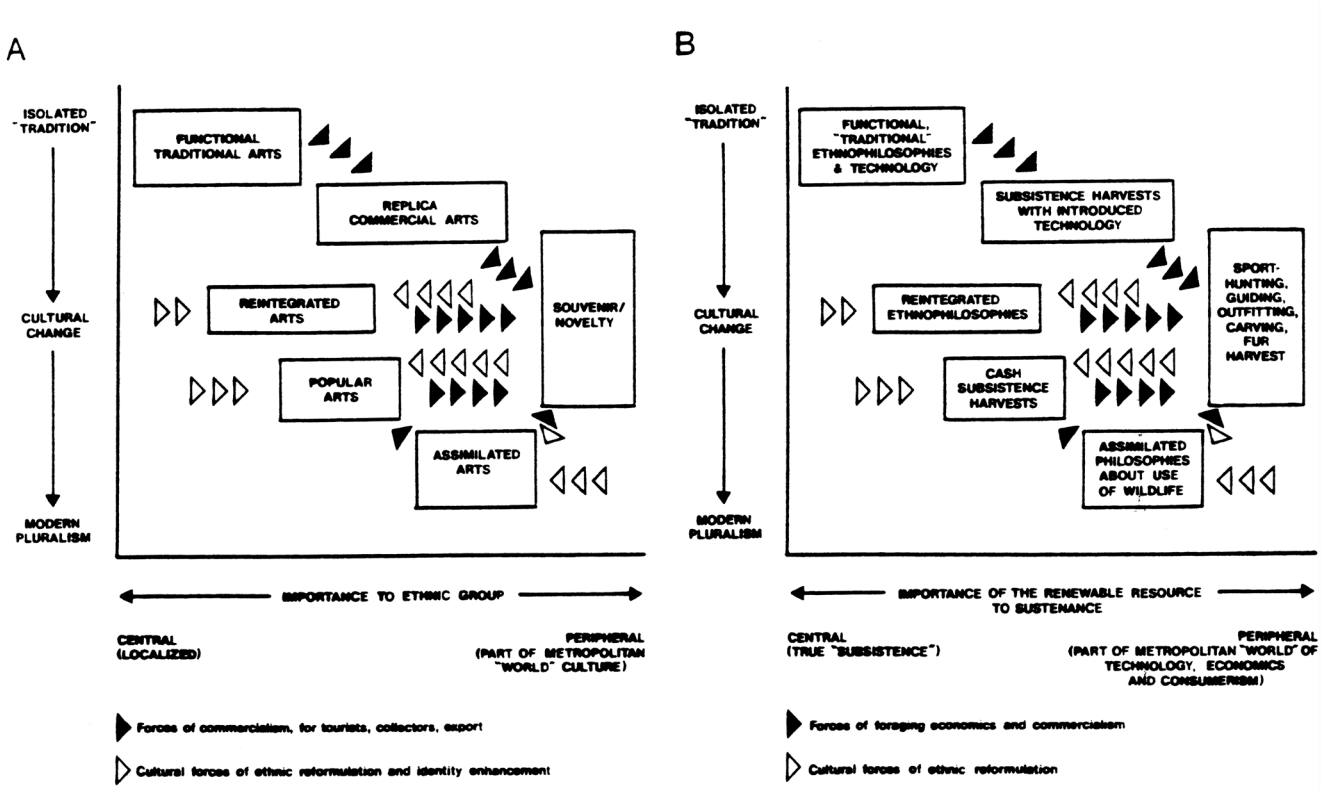

Figure 4. Models for the evolution of tourist arts (A) and ethno-philosophies regarding wildlife harvests (B) showing analogous stages in the evolution of each. (Figure A is redrawn after Graburn 1984.)

forms with little similarity to their historical counterparts, nor much cultural significance, so too have new reasons to harvest wildlife emerged, some with little similarity to historically important reasons (Figure 4). The purposes of wildlife harvests have evolved further from sustenance and closer to "subsistence" (as redefined to include the generation of cash flow). As northern cultures continue to assimilate philosophies about the purposes and management of wildlife harvests, ethno-philosophies will continue to evolve to incorporate more integration among traditions and technologies of different cultures.

Summary

The absence of "intrinsic" regulatory mechanisms in human populations, decreased energetic costs of foraging resulting from modern technology, and increased pressure to harvest prey for its monetary value lead to, generally, overexploitation and extinction of renewable resources. These same reasons may eventually lead to, specifically, lifestyles of northern peoples deprived of wildlife harvests. The analyses in this paper, however, by identifying the factors that favour over-exploitation of renewable resources by humans, suggest the direction of policy initiatives to mitigate their effects. The removal of the "subsidized" energetic costs of hunting, for example, would lead to less waste. For obvious reasons, however, a return to the hunting technology used by northern peoples prior to European contact is out of the question. More realistically, modern technology can be adapted so that prey is not wasted. Kemper (1980), for example, suggested some form of modern weapon to kill whales, but to which would be attached a device to enable hunters to retrieve the prey. More problematical is the removal of the economic incentives to use prey for their non-

nutritious parts.

The solution appears to lie in adherence to strictly enforced hunting regulations regarding quotas and allowable use of technology if northern peoples really desire lifestyles that incorporate both sustainable harvests of wildlife and the amenities of other cultures that only money can buy. Because of factors like the energetics of foraging and the economic value of non-nutritional parts of prey, it would seem otherwise to be wishful thinking that northern peoples (or any humans!) might somehow "intrinsically" regulate harvests of wildlife (see Berkes 1981) in the absence of regulations. Clearly, access to wildlife with modern technology and evolved philosophies, but without careful, concomitant regulation, is not in the long-term best interests of northern peoples.

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Commentary on Figures

Figure 1.

The net rate of change in the number of individuals in a prey population, H, is given by the difference between the rate of change in the absence of predators, rH (where r is the per capita birth rate of the prey and H is the number of prey), and the rate of removal by predators, pHP. The rate of prey removal is assumed to be directly proportional to the probability of chance encounters between predators and prey, and will vary directly with the product of the densities of predators and prey, and with the efficiency of predation, p. Thus $\dot{H} = rH - pHP$. Similarly, the rate of change in the number of individuals in the predator population, P, is the difference between the product of the number of prey eaten, pHP, and the efficiency of conversion of prey into offspring, a, and the product of the death rate of predators, d, and population size, P. Hence, $\dot{P} = apHP - dP$. When the population sizes of predators and prey are in equilibrium ($\dot{H} = 0$ and $\dot{P} = 0$), then $rH = pHP$ and $apHP = dP$. The equilibrium population sizes are then $\hat{H} = d/ap$ and $\hat{P} = r/p$. A graph of predator abundance versus prey abundance can be divided into four quadrants. Counter-clockwise, from the upper left quadrant, predator density is high, but prey density is low; predator densities decline, so the arrow depicting population trajectories over time moves into the lower left quadrant. Now predator density is low, so prey density can increase, moving the trajectory to the lower right quadrant. With prey density increasing, predators can increase again, and the trajectory moves to the upper right quadrant, and so on. If predator densities remain controlled by the density or availability of prey, then a stable cycle should persist indefinitely, as on the left. If, however, the efficiency of predation, p, or some other factor changes that favours an increased rate of growth of P relative to H, then the trajectory swings off of its stable cycle, causing prey density to go to zero as on the right. Unless the predator has alternate resources on which to live, it could go to extinction also (after Ricklefs 1979).

Figure 2.
Graphical representation of why predators sometimes partially consume prey. Plotted from zero to the right on the horizontal axis is T, the amount of time spent consuming a prey item, and on the vertical axis is cT, the caloric gain from feeding on the prey for T time units. Plotted from zero and increasing to the left on the horizontal axis is t_h+s, the total time spent handling and searching for prey. The curve is concave downward because, for predators that must take more than a single bite to consume a prey item, the best parts are eaten first and then progressively less rewarding parts are eaten. Thus, the predator consumes more absolute energy as T increases, but at a decreasing rate of intake. The solution to the problem of how long a predator should spend consuming a given prey item, given the expectation of finding other prey items, is found by drawing a line from the horizontal axis at t_h+s to the point at which it is tangential to the curve. When t_h+s is low (prey are easier to find and/or capture because they are either absolutely or relatively abundant), the intersection point lies closer to the origin of the figure. Thus, the predator should spend less time consuming the prey item than when t_h+s is high. When t_h+s is high and prey are harder to find and/or capture, the intersection point lies further right, indicating that the predator should consume more of the prey item (after Sih 1980).

Figure 3.
The difference between biological yield, and economic yield, from a renewable resource because of the effect of discounted future earnings. The goal of a sustainable yield harvest is to perpetuate a relatively constant harvest of individuals. However, when the renewable resource has a cash value, and if its value when converted to cash grows more quickly than its cash value when left unharvested, then practising a "conservation ethic" to achieve a sustainable biological yield really represents missed economic opportunities. When predators harvest prey for more than immediate sustenance, but instead (or in addition) to accumulate material wealth, economics dictates against employing a sustainable harvest strategy.

Self-management and State-management: Forms of Knowing and Managing Northern Wildlife

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This paper examines the relationship between local systems of self-management and systems of state-management of wildlife in the Canadian North. Given the theme of the conference, it places special emphasis on the forms of knowledge and knowing in each system, and on how knowledge is related to action.[1]

State Mandated Wildlife Management — A Social Scientists' View from the North

Looking from the perspective of several decades, indigenous populations around the circumpolar world have found themselves increasingly encapsulated in nation states. That is, from being wholly autonomous societies in essentially complete control of their own daily lives, and in effective control of the land and resources which they utilized, they have become societies enmeshed in complex relationships to the wider world, and in particular to the national states and to international economies. Some of these linkages have been welcomed, and indeed actively sought, others have been unanticipated or imposed. The process is complicated, and many aspects are beyond the scope of this paper, but it is essential to highlight that these changes are occurring between two societies with unequal resources and sources of power. The power differences are relative, and indigenous societies have shown considerable capacity to reproduce themselves in the context of change. It is also clear that while the institutions of industrial societies have not always succeeded in bringing about the changes they desired in the North, they are a greater threat to the potential for continued development of indigenous societies, than the reverse. These conflicts and threats are manifest in the uses made of land and natural resources.

Into the circumpolar setting of expanding national or international development of land and resources, and of local resistance, the national governments have increasingly inserted environmental scientists, planners and wildlife managers. This may seem a rather stark, and possibly a one-sided perspective from which to view the development of northern conservation and wildlife management, but I think it accurately reflects something of how this development looks when perceived in the North, as opposed to alternative perspectives developed by wildlife specialists in the South. From this northern perspective government-mandated wildlife research and management is often seen as part of a process of intrusion, enhancing centralized control rather than contributing to local autonomy and self-governance. This is of course not the intention of the individual wildlife biologists and managers themselves, but it is a

[1] A longer version of this paper can be found in *Traditional Knowledge and Renewable Resource Management in Northern Regions*, Milton Freeman and Ludwig N. Carbyn, eds., 1988. Edmonton: Boreal Institute for Northern Studies, Occasional Publication No. 23.

result of the context in which they work. Those wildlife specialists who see and are concerned by this process often are able to moderate the impacts of their own undertakings, but without altering the context. The reaction of indigenous hunters to wildlife professionals is not in my experience typically hostile, but they are cautious and deeply concerned about the implications of state-mandated wildlife management for their own local practices. And such concerns are not without foundation, for they emerge from previous experience, and they are consistent with what appears to have been happening over many years in the South.

The intransigence of the increasing environmental problems throughout the world has moved the primary focus of conservation concerns away from the local level to the international and global levels, toward a focus on governmental policy makers and bureaucrats as the primary agents for action. It is important to note that this trend is not a response to the disinterest by, or evidence of the ineffectiveness of, local level responses to environmental management at the local or regional levels; but rather to the need to respond to the continuing environmental deterioration which follows from the generally limited priority given to environmental and ecological issues in national and international economic and policy making. As a consequence, these recent approaches tend not to encourage or support local initiatives, local control of environments and resources, and local conservation measures as a primary goal and strategy.

I contend that these directions are insufficient when dealing with the North, and with other regions in which local communities or regional societies predominate, and where long term occupation and use of lands and wildlife by socially-organized communities of resource users continues. I would argue that the present governmental strategies being followed are essential, but that they are insufficient, and fail to advance opportunities for conservation in the Canadian North through forms of local management.

These opportunities are essentially tied to the possibilities and realities of local and regional level management and conservation by the local northern communities themselves. Many indigenous groups in the Canadian North assert that they do presently manage renewable resources without depending on the intervention of national or provincial governments. Those which do not assert this tend to claim that they could do so in the future; and both groups assert that they did manage renewable resources over a long historical period. These claims are based on forms of self-management.

Self-management, State-management and Co-management — Definitions

I use the term self-management in a specific sense, namely as the local or regional level systems for regulating the use of wildlife and/or for managing the wildlife themselves, which originate and are legitimated and practiced by local or regional societies, or groups of resource users. Self-management in short is the direct exercise of effective managerial and regulatory practices with respect to wildlife and land. The legitimacy and authority for such practices are determined at the local level by reference to community-based systems of knowledge, values and practice. Furthermore, they are especially embedded in local practices and knowledge with respect to world view, property rights, social authority, and the definition of the sacred.

State-management is management deriving from the authority of the law of a nation state, usually from the constitutional powers exercised by legislatures or executives. State-management in North America is typified by several characteristics. The day-to-day administration of state-management in North America is not usually in the hands of groups of resource users, but is conducted by a highly professionalized group of administrators and scientists. State-management tends to emphasize national or provincial/territorial interest over local interests, because of the structure of legislative power, by which state-management is established. State-management therefore also operates within a legal system which has placed greater weight on non-wildlife resources such as forests and minerals than it does on wildlife, thus complementing the state-level priority on develop-

ment. Unfortunately, the administrative departments with responsibilities for wildlife management generally exercise limited political weight within their respective governmental structures, although often staffed by very dedicated personnel.

Co-management, as generally defined, involves some working arrangement between state-mandated agents and individuals or groups of wildlife users who themselves have a role in managing the resources (Pinkerton, in press). Co-management may involve various linkages with self-management systems, or the resource users who participate in co-management may be individuals whose mandate and authority does not derive from local institutions, but from the appointment to the co-management body itself. Nevertheless, co-management may serve as an important institution linking self-managers and state-managers.

While it might be assumed that self-management practices must be an exceptional development, there is increasing evidence of local level systems for control of wildlife resources from diverse parts of the world, including northern North America, and with respect to diverse species (cf. McCay and Acheson 1987).

Research on northern North American indigenous communities has examined culturally distinctive social methods of regulating access to resources, sustainable yield harvesting strategies, social systems of production, distribution and consumption affecting resource use practices, customary law and systems of rights regulating decision-making and access to resources, and systems of language, ritual and spiritual beliefs which shape the interpretation of environmental experience and knowledge. A more limited, but nevertheless important set of studies, has compared and tested actual resource use practices with their biological outcomes, and with recognized management objectives.

It seems reasonable to assume that systems of self-management must have been widespread and common throughout human prehistory. This makes it essential to examine their continued presence in the contemporary world, where their existence and functioning can be researched. This is particularly important in areas such as the Canadian North where there has generally been only limited disruption of the environment, limited management by the state, and limited although growing competition for resources.

Culture and Environmental Knowledge

The systematic study of ecological knowledge began in a series of studies eliciting and analyzing the terminologies by which people in different cultures classify the objects in their natural and social environments, and particularly their classification of the different types of living things, what we would call a species classification. The studies of classification systems have shown that all peoples recognize what they consider to be natural classes of animals and plants. The extent of this knowledge is often prodigious. A now classical study of a Philippine horticultural people, the Hanunoo recorded 1800 different types of locally-recognized plants (Conklin 1954).

Research with the Waswanipi Cree, with whom I worked, and who live in the much less diverse sub-arctic environment (Figure 1), showed that Cree and biologists have on occasion communicated about their respective classifications of animals, and have been able to convince each other of the appropriateness of their categories despite the differences in their classifications. Thus, one Cree woman reported that when her father worked for fisheries biologists they showed him that mooneye and goldeye could be systematically distinguished as different types of fish, a distinction most Waswanipi do not make. On the other hand one fisheries biologist reports that Waswanipi guides pointed out two types of sturgeon to him, and this difference appears to be accepted as a sub-species level distinction in the biological literature (Magnin 1964:278-279; Roussow 1957:55; and LeJeune 1965:70). These cases indicate that there is some cross-cultural communication possible about the classification of the natural world, despite the cultural differences.

This does not mean however that the systems of knowledge can be simply equated. The studies which show the reasonable levels of correspondence between lower levels of the classifications,

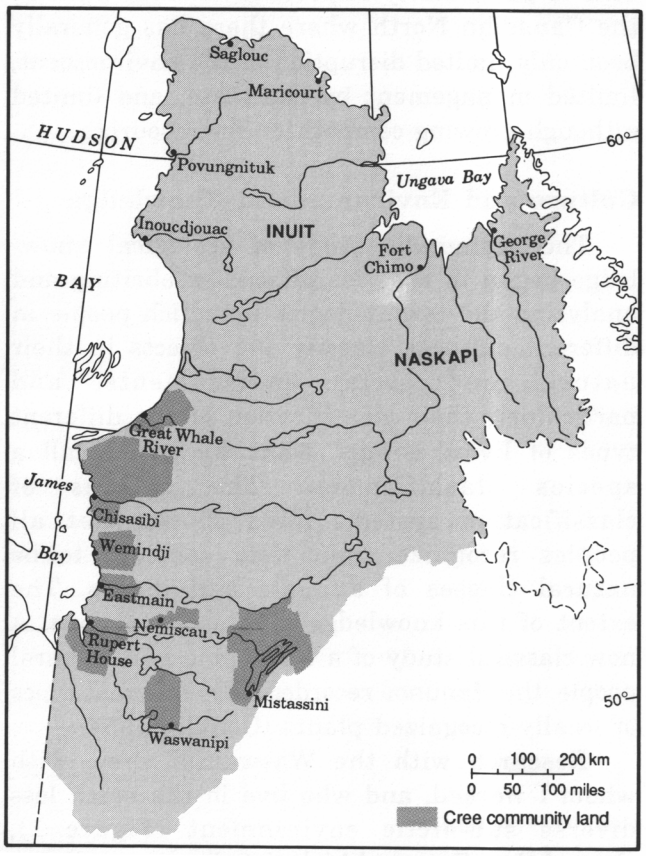

Figure 1. Cree lands under the James Bay and Northern Quebec Agreement

also show clearly that higher level categories of classifications, which group together types of animals or plants, vary considerably from culture to culture. Such categories are often not based on multiple criteria, but on single criteria, and cultural systems vary according to which criteria are used for higher order groupings. Thus the Western scientific system of species classification emphasizes morphology at the intermediate levels of classification, because of the accessibility of morphological data and their relevance for the models of evolutionary connections among species. By contrast, the Cree place primary emphasis in their classifications upon what the animals eat, and secondarily on the habitats in which they live.

Furthermore, additional studies have shown that the basic categories may be related together at the middle levels of the classification by different principles — taxonomies, paradigms, tree structures, hierarchical rankings, clusters, and others. Thus, for example, Ojibwa and Waswanipi Cree classifications of living things seem best to fit into ranking hierarchies rather than into taxonomic classifications (Black 1967; Hallowell 1955, 1976; Feit 1978).

But whatever the pattern, the studies have shown the inherent logical character of all systems studied to date, and they have shown that peoples in all cultures are as much concerned to bring classificatory order to their world as are Western scientists (Berlin 1973). Indeed, at the highest levels of the classification schemes, a division between plants and animals would appear to be universal, although the actual classificatory boundaries will vary. Furthermore, the more comprehensive and complex studies have shown the very considerable knowledge about environmental relationships and processes which hunting and horticultural peoples have.

For the Waswanipi Cree, the classification of animals involves a hierarchy which links animals to men and both to spirits and to God. Animals are social beings, not cut off from humans as part of a natural order separated from human society. And Waswanipi therefore interpret animal actions as the results of wilful choice on the part of the animals. Animals in turn are interpreted as social beings capable of interpreting and understanding the actions of men. The Waswanipi hunters say that they only catch an animal when the animal gives itself to them, or is given them by God and the spirits. They are given animals because they respectfully ask for what they need to survive, and their requests are heard. And they are under reciprocal obligation for what they receive, and treat the animals with respect in the way they hunt, butcher, consume and use the animal bodies. This respect is expected and appreciated by the animals, whose souls survive to be reborn again. With the rebirth of animals, respectful and thankful men may find the animals and the food they need to survive for the duration of their own lives, and to raise their children in turn. When hunters act properly, animals' souls survive, and animals continue to be reborn, in health and numbers, and humans too lead

healthy lives. The balance is reciprocal. It is stated that hunters have the skill and technology to kill too many animals, and it is part of the responsibilities of the hunters not to kill more than they are given. How signs from the animals and the spirits tell them how many can be taken will be indicated briefly below, but these signs involve complex observations and interpretations of weather, snow, vegetation and animal population parameters, all of which are considered as communications from animals and the spirits.

This understanding is decidedly different from that achieved by Western science. However, both construct and incorporate vast bodies of knowledge about northern environments, both involve construction of models to give meaning to those worlds. Western science constructs and uses an organismic model, which ecology has been increasingly applying to the natural world, the ecosystem model. Thus ecological models break down the barriers erected prior to the 19th century between the organic and the inorganic world, and these models show how animal and habitat are incorporated in a complex system not unlike that of an organism. The Cree for their part construct a social world, a world which they have extended to all potentially active entities in their experience. Both models constitute a world of complex reticulate causalities, linking the human, the organic and the inorganic. Both models anticipate the possibility and the desirability of a balanced participation of humans in their worlds. Both models organize extensive factual information in a form which tends to motivate appropriate action. And both models tend to help humans understand their worlds and acknowledge responsibility for it.

One concludes then that all systems of human knowledge are created by similar processes, and are more alike than the focus on their surface differences would lead us to believe. It is clear that all human systems of knowledge incorporate considerable information, and warrant thoughtful study and practical respect.

But, if forms of knowing are not very different, even if the systems of knowledge themselves are clearly distinctive in structure, what about the applications of knowledge, how do they vary? In order to examine this question we shall need to consider the social processes involved in the creation and use of knowledge in practice. We need to examine if and how environmental conservation and management may be possible given the kinds of knowledge available to northern hunters and to scientific managers.

The Practice of Self-management

While general knowledge establishes the basic structures of the world in which we live, specific knowledge of the particular contexts and situations in which we must act is continually being sought and used. Current information on the condition and history of game populations is essential in order to apply generalized knowledge and principles to particular circumstances, and wildlife managers are continually collecting such knowledge. This is as true for local level managers as for state-mandated managers.

For example, as previously reported (Feit 1986b), information on the composition of beaver colonies is continually collected by Waswanipi hunters from signs of the beaver around the sites, from the sizes and sexes of the beaver caught, and from information collected in the process of butchering beaver. Waswanipi hunters work with a model of the growth of beaver colonies: first year colonies are comprised of founding couples, second year colonies are typically comprised of six beaver — namely adults with kits of the year, and third year or older colonies typically have 10 to 12 beaver comprised of adults with yearlings plus kits of the year (Feit 1978). The latter composition is considered potentially stable through out-migration of the two year old beaver.

Knowledge of beaver colonies being hunted, of their age and sex composition is sought in order to determine how many beaver are present and how many may be taken. Knowing the history and age of a colony gives some idea of the possible composition, according to the model, but this must be adapted to particular instances. Tooth marks on wood cuttings around a pond,

how bank burrows far from the lodge are used, and other indicators all provide useful information on whether kits or yearlings may be present. The size of the last cohort born to a mating female can be determined if she is caught, because women look for placental scars on the uterus when butchering beaver. Hunters never know for sure how many beaver there are in a lodge, but they make increasingly accurate estimates as their observations increase, and as they watch for signs of the activities of the remaining beaver, and as they learn from the trapping process which ages and sexes of animals are definitely present. Furthermore trends in the numbers of colonies, in the abandonment of sites, the size of cohorts, and in the numbers of unmated beavers are continually being noted.

When the Cree hunters who were in charge of specific hunting territories were interviewed in land use surveys in the 1970s it was found that they could not only mark on a map the beaver lodges occurring in a hunting territory in excess of 300 sq. km., but many could indicate how many beaver of each age and sex category had been harvested the last time a lodge was trapped, and some could go on to indicate how many of each age group they thought were still to be found at the colony. This inventory often involved a report on 50 to 100 beaver colonies. The hunters were the first to say that they were not absolutely certain of these numbers, but they would discuss the observations and assumptions they made in order to make these estimates. For moose similar patterns of monitoring go on, although for a more dispersed population (Feit 1987).

In both cases the parameters monitored are all ones which wildlife biologists have found to be important indicators of the condition of the game populations and useful indicators for management decisions concerning the sustainability of present harvests (Feit 1978). Absolute numbers are not recorded, but trends in the basic parameters are noted and discussed by Waswanipi hunters. These trends are not understood in the same way by scientists, because for the Cree these indicators are treated as a form of social communication, a message from the animals concerning their willingness to continue to be harvested. Nevertheless, the consequences for the planning of future harvest levels are not entirely dissimilar for the Cree as for other wildlife managers.

However the level of information available to the Cree is fundamentally different from that available to the scientist/managers. The scientist/managers typically have results from only periodic surveys of one or more parameters, measured by sampling over a very extensive area. And to interpret these data they typically use generalized ranges derived from the few intensive scientific surveys conducted in more or less comparable environments. For example, when beaver quotas were being set in the 1960s in northern Quebec the assumed number of beaver per lodge was based on data from Michigan and Alaska collected in the 1940s and early 1950s.

When research was undertaken to directly measure the size of beaver colonies by a government scientist in the 1970s, a number of colonies were trapped out in order to estimate their composition; local Cree were neither interviewed nor was their assistance enlisted. The number of beaver the scientist trapped out, and his estimate of the size of the colonies was distinctly lower than the average number of beaver the Cree removed from the colonies which they thought they had successfully trapped out. The scientific study appeared to say more about the trapping abilities of the researcher than about the beaver. The result, unfortunately, also says something about the way some wildlife biologists treat local knowledge and experience. The knowledge available to local managers and to state-mandated managers is different, but if the effort is made to share both types of information it would often be found that they are mutually informative.

Social Organization of Knowledge

The monitoring of indicators, and the type of information the hunters use is not universally available within a local community, for it is knowledge which typically is synthesized only by a limited number of people who generally are leaders in hunting activities. These may be hunting territory bosses, or the leaders of hunting parties or camps.

The social distribution of knowledge is related in part to the conditions required for creating such knowledge in the first place. The James Bay Cree system of monitoring certain manageable wildlife populations, for example, requires that hunting leaders gain knowledge of the wildlife populations either on appropriately sized areas of land, or in the case of migratory or widely ranging species that they distinguish recurrent natural population sub-units within the migrating population. The recognition of such natural population units has been reported among Cree goose hunters (Berkes 1982; Scott 1986). For such wide ranging and migratory species, information may also depend on sharing knowledge among several hunting leaders.

Thus, Cree hunting bosses are aided in their judgments of the significance of trends in the wildlife populations on their hunting lands by hearing from others whether similar trends are occurring elsewhere. For knowledge of current trends to be meaningful, it is also necessary that hunting leaders know the history of the wildlife populations which they are observing. This permits evaluating the duration and intensity of the trends, as well as making it possible to relate different points in the development of the trends to specific changes in the environment, or to the history of harvesting intensity. Furthermore, in a region noted for its variability, it is useful to know something of the range of past variability, and also of the climatic or vegetational conditions, if any, which may be associated with some of the variability.

Finally, the hunt leaders find it useful to know the history of the harvests taken from a given population, because this is the variable which they have some influence or control over, and they need to judge the significance of past and current harvest levels for the trends being observed. Hunting leaders actively collect and are given such information. Hunting leaders typically see or hear about the harvests taken by all or most of the other hunters using their territory or living in their camp. The gathering of knowledge is thus not simply an individual affair, it is a socially structured process in which a group of hunting leaders or elders have extended access to the available information. In turn, these leaders are expected, under appropriate circumstances, to impart useful or interesting explanations to others concerning the behavior of wildlife populations in their territory.

Such leaders not only are expected to synthesize knowledge, they usually expect and are expected to play the key role in social decision-making concerning the future harvests. These roles may vary from community to community and from activity to activity, and may range from providing wise counsel to other hunters, to being able to actually direct hunting activities. In James Bay Cree society such direction is typically conducted in extremely subtle ways, so as not to interfere with the autonomous responsibility of each hunter; nevertheless, there are recognized bosses or leaders for most intensive harvesting activities, and there is a complex system of hunting territories and hunting camps which are supervised by hunting bosses who are usually elders.

The application of such knowledge may conserve animals, it may anticipate or respond to declines in game populations and help prevent further declines, it may increase the efficiency of the harvest, or decrease the uncertainty of a harvest. Often people speak as if it does several of these things together, depending on the circumstances and the knowledge possessed by the hunt leaders.

Both hunting knowledge and hunting practices are therefore part of a complex social system in the societies in which these patterns have been examined, and probably more widely in the arctic and sub-arctic regions. Several researchers have noted the important connection between knowledge and hunting practices in the James Bay area (Weinstein 1976; Berkes 1977; Tanner 1979; Scott 1983).

My own research at Waswanipi Quebec has led me to conclude that the relative stability of both populations and harvests of moose and beaver over a ten to fifteen year period is significant evidence of a real level of success of Waswanipi conservation and management practices, as well as of the potential sustainability of the harvest levels being practiced in a har-

vesting system which emphasizes the rotational use of hunting territories (1986a, 1986b, 1987).

Studies in the Western subarctic have been less extensive, but tend to parallel aspects of the conclusions cited above (see especially Lewis 1977 and 1982; Brody 1981; and Nelson 1982 and 1983). Studies in Alaska have complemented those in Canada, indicating the forms of social integration of wildlife resource use practices with the wider economic, social and cultural systems of local communities. The Alaskan studies also show the development of new and effective local-level conservation institutions and practices in response to both growing local concerns to protect wildlife populations and to growing intrusion by outside agencies (see Freeman in press; Feldman 1986).

The relative uniformity of conclusions of these studies with respect to the concern of Native hunters for their environments, their effective creation and use of important bodies of environmental knowledge, and their systematic attempts to apply such knowledge to wildlife resource harvesting practices in such a way as to manage or conserve resources should not surprise us. It only makes good sense for people who want and expect to see continuing generations maintain close ties to the animals and the land they occupy and use. We do not need to exaggerate their success to note the intensity of the effort, and the fact that it is often, although not always, successful.

These results from the Canadian North are echoed, at least in part at the recent symposia and volumes on traditional knowledge and conservation in local communities around the world, although it is worth noting that the Canadian research represents, in some respects, the scientific forefront. These studies report a recent resurgence in awareness and appreciation of traditional resource systems, and they note that while destructive practices and effective efforts to conserve natural resources co-existed in most societies, this does not diminish the need to recognize and take account of the traditional methods of management and conservation (see Johannes 1983; McNeely and Pitt 1985).

Such forms of self-management have often been overlooked, because they depend on social institutions and practices unfamiliar in our own society, and fundamentally different from forms of bureaucratic decision-making and highly specialized fields of responsibility which characterize state-mandated wildlife management systems. The growing awareness of self-management systems raises questions about the history and future of such systems.

Histories of Management

In the cases where we know the history of self-management practices we know that they are highly adaptive and resilient systems of wildlife use and management. Thus, among the James Bay Cree, where we know some of the practices in reasonable detail over several decades, and where there is evidence that these systems extend back several centuries, there is good evidence indicating that the practices have been changing and are adapted to continually altering circumstances. Human populations have grown ten-fold in the last eight decades, transportation and harvesting technologies have been greatly enhanced, competing Euro-Canadian wildlife users have entered the region, the Cree have been partially sedentarized and participate in public education systems and wage economies, the fur trade has been monetized and has become more competitive, and wildlife resources have been constantly impacted as forests age, and forestry, mineral and hydro-electric development occurs. Through all of these changes self-management practices have continued to be valued, changed, maintained and relatively effective. These systems have also been extended to apply to significant new resources, such as moose, as well as adapted to previously managed resources. In short, it has been shown that "traditional" local self-management can be adaptive in complex and sometimes rapidly changing conditions, although this is not to say that there have not been problems as well.

The historical record also shows that there have been occasions throughout the Canadian North during which local management has not been effective; however, because this literature is not systematic, it cannot be easily evaluated.

One study (Feit 1986b) detailing the depletion of beaver in the Waswanipi area in the 1930s will be discussed here because some of the conclusions which emerge from this case merit consideration as possible general hypotheses which warrant examination more widely.

The first important conclusion from this case was that the breakdown of self-management was not an "all or nothing" event. The study showed that breakdown can occur only partially, for example it may be specific practices for a particular species that are no longer effective, and it may be temporary and related to specific circumstances. Indeed, partial rather than global problems are more likely, because breakdown of management of one species may put increased importance on the management of other species critical to the users.

Furthermore, management breakdown was accompanied by remedy seeking, and a search for ways to re-establish management of the affected resources, and these remedies were effective. The history of self-management is not therefore a history of continual success, but neither is it a history of continual and cumulative failures. Rather it is a history of the efforts to adapt and maintain self-management to changing circumstances, and it is a history of various forms of disruption and renewal of self-management systems.

The histories of self-management therefore may provide an improved understanding of the conditions which lead to the maintenance, breakdown, and re-establishment of self-management practices, and indeed this should be one of the important goals of ongoing and future research. These questions are just beginning to be examined, yet some preliminary hypotheses can be suggested. It appears that self-management is promoted where local communities or groups have continuing control of access to and use of the managed resources. It is also promoted where these communities retain continuing and long-term interest in the resource, and if they develop alternative and conflicting interests self-management may be weakened. Where the future of the resource appears to be uncertain, despite continuing local interest in it, breakdown may be promoted. In the latter case, as opposed to the case where a change in their interests occurs, efforts to re-establish the conditions for self-management may be common.

In the present context therefore, changes in technology or demography are not in themselves the sources of breakdown, and although they do require adaptations, such adaptations have been made repeatedly in the past. On the other hand, there are more subtle factors with potentially more serious consequences requiring relatively new forms of adaptations. For example, self-management may be disrupted when the institutions or means for gathering and applying information essential to the management of the resource are not effectively maintained or adapted to changing conditions, particularly where new education systems interfere with inter-generational patterns of education and information transmission. The interest of some sectors of the indigenous communities in wildlife may also be changed as efforts grow to create resource-based employment opportunities for a sector of the population which will not be living full time as subsistence hunters. Self-management also depends on the maintenance of social systems defining work group organization and property rights and their legitimation and sanction. And, these social practices can be altered, for example, by the need to incorporate part-time hunters into the social system regulating hunting. They can also be altered by the need to create new structures and practices for exchanges between those in the communities with more adequate cash incomes, who can capitalize hunting, and those who may be short of capital, but want to be intensively engaged in hunting. In the North at the present time there appears to be a range of social experiments and explorations, as communities respond to these relatively new changes.

A pattern of successes and failures of self-management should not be surprising in so changing an environment as the North. And, lest we judge it too rigidly, we must note that it should not surprise us either that scientifically based, state-mandated management has also had an uneven record of accomplishment in the North. Unfortunately, there are few extended

studies of the lessons to be learned from the experiences of state-mandated wildlife management in the Canadian North, nor very much independent evaluative research on specific management cases. While the available research is clearly incomplete, important recent research has begun to identify some of the accomplishments, problems and possibilities inherent in governmental wildlife management policy-making in the North (e.g., McCandless 1985). Some of this research has identified areas in which scientific wildlife management has encountered recurring difficulties relating to indigenous management systems, and while not being competent to adequately review the accomplishments of scientific management in the North, it is important to note the general problems scientific managers have had relating to local self-management.

Milton Freeman has noted two important reasons for repeated problems. One is that frequently used scientific models require information and knowledge which often far exceeds that available, and the managerial response has often been to depend very heavily on assumptions to fill the gaps. This often proves inadequate in an environment where so much basic knowledge is still lacking. Freeman then goes on to note that in some of these cases, indigenous peoples had criticisms of the assumptions used by scientists, and at a local and specific level they formulated knowledge which conflicted with those assumptions, but which did not enter into the state managers' decisions (1985). Thus scientific or state-management has often cut itself off from this significant source of knowledge, under conditions in which it can ill afford not to use all the available information.

In a number of recent papers Peter Usher has argued that wildlife management scientists are themselves largely unaware of the ways that their own scientific enterprise often presupposes and incorporates culturally specific ideas and values which are scientifically unexamined, such as the notions of property and individuality, ideas which are simply assumed in our society and our political institutions (Usher 1986). Usher points out that one of the implications of these features of managers' thought and training is to limit effective appreciation of indigenous knowledge and practices, as the latter are based on distinctive social forms of knowledge and practice, and on collective or communal rights to land and resources. Not only do indigenous systems became difficult to understand, but their existence becomes difficult to recognize at all.

My own observations confirm the consequences of recurring failures of state-mandated managers to take adequate account of local cultures and resource use and management practices. I have seen several instances where objectives have not been achieved by state-sponsored management policies directed at local peoples. In these cases the state managers neither understood the difficulties such rules created for local resource users, nor did they appreciate why such rules could be perceived as lacking legitimacy. In either case, limited enforcement capability led to avoidance strategies on the part of the local resource users which often had impacts quite at variance with either the state-management plans, or with normal local-management practices.

Thus while the available research on state-mandated wildlife management in the Canadian North is probably less developed than the research into local-level management systems, we can see that its own historical record points to both successes and to much needed development and unfulfilled potentials and promises.

Prospects and Conclusions

The question then is how to go forward from here, and the answer I believe must include the continued development of forms of self-management as well as improved forms of state-level wildlife management. And if I may be permitted a potentially provocative assessment, I would hypothesize that on the ground at present, local-level self-management is more widespread, and that it is presently the more effective at conserving the resources, than is state-mandated wildlife management. I believe this assessment is supported by a series of studies which indicate how government-sponsored conservation efforts have been repeatedly subordinated to the interests of the development of

non-living resources, and how they have been limited by the modest support being made available by government for wildlife-resource management in the North (for example, Usher and Beakhust 1973; Freeman and Hackman 1975; Theberge 1981). But whether my hypothesis about their relative presence on the ground is true or not, both self-management and state-management systems will be needed in the future.

Even where self-management is effective today, it is no longer typically sufficient to all the problems local wildlife managers face today in its present forms. Local wildlife-resource uses are only rarely isolated from the impacts of the international economic system or of state policy-making with respect to wildlife and development. National and international commercial interests, sport interests, non-renewable resource developments are all often beyond the direct influence of the practitioners of traditional self-management systems. This is not to say, that there have not been effective local responses in various circumstances. Nevertheless, traditional forms of self-management must respond to these threats to wildlife resources and to environments by extending self-management to new forms which regulate the actions of individuals and agencies outside the local or regional groups. This provides an incentive to change, if for no other reason than that many of the forms of wildlife management and environmental protection now needed are difficult to respond to effectively at the scale of the existing systems of self-management, and require institutions and practices at a regional or wider scale. Such institutions and practices can develop as forms of self-management, but they also constitute an incentive towards co-management, or a combination of the two.

With respect to the future development of self-management systems, the main point I would make is that self-management practices have histories, and from those histories we can learn something of the conditions under which self-management is maintained, under which it may breakdown, and we can also learn something of the conditions which can facilitate and enhance self-management in the future.

Given that self-management has a reality and a history, then I think that history also shows us that self-management exists today in a milieu in which there are also real pressures for strengthening state-mandated management as well as for instituting forms of co-management. With respect to state-management, it clearly needs to be linked to self-management systems to fill gaps in knowledge, to determine realistic objectives, to fit local practices, and to build ties to local communities where policy decisions must be respected in order to be effectively implemented.

With respect to forms of co-management, they are especially likely to be promoted in part through the negotiation of aboriginal rights, but they are needed in the short run and without waiting for the outcomes of those negotiations. In the future, it will be important not only to continue development of the concepts and practical structures of co-management, but also some form of clear recognition that co-management arrangements themselves derive from the systems of knowledge and social rights of the groups agreeing to co-manage with the state, as well as from the legal system of the state.

While a co-management system is likely to be given legal force within the structures of the state, co-management which is capable of being recognized as legitimate and effective in the North will in most cases have to be based on and express forms of pre-existing self-management. Various principles of international as well as constitutional law need to be mobilized to give adequate recognition to the dual sources, state and local, for co-management in the northern context.

The thrust of this analysis is that both self-managing and state-level managing systems exist, and have a future; and that in a real and practical sense they are now inseparably interlinked, and in many ways they are necessary to each other.

Given these conclusions, two questions seem central to further analyses. One is whether the pressures for change will result in extensive co-management systems, or whether they will result in a little co-management and much more expanded self-management. A complementary

question is whether co-management will in the long term come to constitute a form of co-optation and domination, which will weaken self-management and self-governance. I think that the answer will depend on whether forms of co-management can be developed which effectively recognize the autonomy of self-managers, and their participation with equal authority, legal standing, resources, and respect.

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Towards a Network of Knowing and of Planning in Northern Canada

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Introduction

The title of this conference, "Knowing the North," suggests only one of four key interactions necessary to assure a sustainable and equitable future in Northern Canada: the South knowing and thus understanding the North. Clearly there are three other interactions required to complete the appropriate network of understanding: the South knowing the South, the North knowing the South and the North knowing the North. These four interactions form "a network of knowing" that is essential to the support of sustainable and equitable planning strategies throughout Northern Canada.

A detailed discussion of the ways in which knowledge is organized, acquired, transmitted and used is, of course, beyond the scope of this paper. Yet these issues are central to our understanding of the knowledge network that inform our strategies and our plans. Each of the four interactions of the knowledge network that relate the South and the North is based on a set of paradigms and on a set of practices related to these paradigms. Derived from the Greek "paradigma" or pattern, a paradigm has been characterized as a framework of thought, a scheme for understanding and explaining certain aspects of reality (Ferguson 1980:27).

At critical points, however, what we think we understand is challenged by singular voices whose insights cast doubt on common practice and challenge the paradigms that support such practice. In 1866, for instance, George Perkins Marsh (1965:66-67) warned that "man has too long forgotten that the earth was given to him for usufruct alone not for consumption, still less for profligate waste...." More than 100 years later, the World Conservation Strategy was designed to address the pressing problems of the conservation and development of the living resources of the globe (IUCN 1980). The strategy focuses on achieving sustainable development, and has stimulated numerous initiatives in the South and the North of Canada in which both Native and non-Native Canadians have participated actively (Jacobs 1981b, 1985).

In a recent conference held to review progress in implementing the World Conservation Strategy and in achieving sustainable development, Dr. Swaminathan, president of IUCN, proposed that we expand the underlying concept of the WCS to "include the idea of sustainable and *equitable* use of our life support systems and natural endowments" (Swaminathan 1986). The introduction of "equity" raises important issues of our individual and collective behaviour with regard to the environment, and the values that this behaviour reflects.

II. Environment and Values

Our idea of nature is reflected in our values (Glacken 1967), values that are expressed in numerous human relationships with the biosphere; through its contemplation, through its sustained used and all too frequently through its abuse and exploitation. The distinction between sustainable use and abuse may well be an issue of relative values that forms the basis of philosophical enquiry in ethics (Rolston 1981), as well as in environmental planning and management (Tribe 1976).

That values are relative to their cultural and

temporal setting may be illustrated by three views of hunting.

The view of Inuit

> All the creatures that we have to kill and eat, all those that we have to strike down to make clothes for ourselves, have souls, souls that do not perish with their bodies, and must therefore be pacified lest they should revenge themselves on us for taking away their bodies [Roberts 1986:53].

The view of the philosopher

Ortega y Gasset suggests in the summary of the chapter on the ethics of hunting "one does not hunt in order to kill; on the contrary one kills in order to have hunted" (Ortega y Gasset 1972:97).

The case for animal rights

> Like us, animals have certain basic moral rights, including, in particular, the fundamental moral rights to be treated with the respect that, as possessors of inherent value, they are due as a matter of strict justice. Like us ... they must never be treated as if they were receptacles of intrinsic values and any harm that is done to them must be consistent with the recognition of their equal inherent value and their equal prima facia right not to be harmed [Regan 1983:329].

Clearly, each view of hunting is an expression of a value system associated with our idea of nature, and serves as an allegory of our relationship with nature. These three views are also allegories of the different perspectives that inform the knowledge network with which we are dealing in "knowing the North." To know the North, we must know the South as well, and appreciate the shifting perspectives that inform southern culture and values. Less than a century separates the ethnocentric view of hunting expressed by Ortega y Gasset and the biocentric view of the animal rights movement.

III. Paradigms that Reflect our Idea of Landscape

The Landscape was and remains symbol, home, setting and larder. It is all of these at one and the same time. That this is so is due in large measure to the nature of the paradigms that frame our views of nature and of the Landscape, and to the changes that have occurred in these paradigms over time (Shepard 1967). Nowhere have these changes found more careful expression than in the area of artistic and aesthetic endeavour.

There are few occasions in our southern network of knowing when the relationship of culture and art have been so closely allied as in the architecture of the medieval cathedrals. What has become for us a matter of poetry, of art, and of literature was for those of the middle ages the reality of a supernatural operation, the manifestation of an admirable mystery (Grodecki 1958:39).

Consider the language of the stained glass windows, a language of light and colour, of signs and symbols. History and moral philosophy was told in these windows that formed the basis of popular knowledge transmitted orally and visually to an essentially pre-literate people. Religious philosophies that dealt with the material and immaterial aspects of the sacred and the profane were made manifest in the cathedrals that were designed to receive light and in the windows through which the light penetrated.

Saint Bernard spoke of the incarnations and of the Virgin birth in images directly related to the power of light:

> Comme la splendeur du soleil traverse le verre sans le briser et pénètre la solidité de son impalpable subtilité, sans le trouer quand il entre, et sans le briser quand il sort, ainsi le Verbe de Dieu, lumière du Père, pénètre la demeure de la Vierge et sort de son sein intact, [ibid:40]

That God is light and makes himself known through light was the central premise of an enchanted world, a southern world, a world that changed with the advent of the "age of reason" where value and fact were split asunder

(Berman 1981, Jacobs 1985).

As early as the 16th century, the Landscape began to be portrayed in a representative manner. The play of light and shadow and the concern with perspective, depth, and Landscape components were, however, subordinate to the narrative content of the drawing. The Landscape was a backdrop or the "mise-en-scène," its role was that of supporting a message, usually of a moral character.

During the 16th century two clear styles of Landscape portrayal emerged, that of the "ideal" Landscape and the "topographic" Landscape. The former is composed of pre-ordained detail derived from reality but organized to depict a particular mood and to reflect the artists' image of the Landscape. The topographical Landscape was based on an objective recording of a specific locale or situation used as the predominant motif of the drawing frequently without reference to human figures or to narrative content.

During the 17th century the bird's eye approach to the depiction of the Landscape gave way to a more human perspective point, the moral and religious was replaced by the more ordinary scenes of every day, and the use of explicit detail was displaced in favour of a generalized conception of Landscape space. By the 19th century, Landscape became the key focus of the Impressioniste with emphasis placed on impressions on nature in flux, whereas the expressioniste focused on the evocation or suggestion of a Landscape mood.

The shifting perspectives of the Landscape illustrate just how much our concept of the Landscape setting and our perception of that setting changed over a very few centuries. Commenting on a trip through the Alps in the early 18th century, Thomas Gray remarked that the creatures that inhabited the Alps "are in all respects below humanity." Theological support for this premise was supplied by Bishop Burnet's "Sacred Theory of the Earth" published in 1688 in which he asserted that before the flood the world was a perfectly smooth orb. As punishment for man's sins the interior fluids were allowed to break through the crust, piling up "vast and undigested heaps of stone and earth" those great ruins we call mountains.... By the 19th century, Byron and Wordsworth had elevated mountains to the status of "Solome Temples," "natural cathedrals," and "natural altars" (Rees 1975). These changes affect the choice of strategies and actions that we use to manage the Landscape that we inhabit. Not only has our idea of the Landscape shifted through time, so too have the symbolic and utilitarian importance that we assign various views of the Landscape.

The concept of mountain wilderness, for instance, changes dramatically depending on the temporal and physical setting within which it is perceived.

Mt. Sinai is at once symbolic of wilderness and of the wandering of an essentially nomadic but free people. Paradoxically this intense sense of wilderness is the very source of the Code of Law that governs much of Western civilization.

A second mountain scene also rises from a desert in the high arctic of Canada. Perceived perhaps as the epitome of desolation, the high arctic reaches serve to condition the air we breath, to shelter critical habitats and species, as well as harbouring rich resources of minerals and hydrocarbons. It too is the home of a nomadic and free people.

A third scene is one of the Mount Royal mountain, a back-drop to the emerging commercial capital of "la Nouvelle-France." Here wilderness hides the savage — that is non-Christian — Indian and symbolizes the unproductive even wasteful excesses of nature. Nomadism was of course fraught with danger yet essential to the fur trade and to the settlement of the "new world."

A fourth scene is of the wilderness range in the Canadian Rocky Mountains. Wilderness here, is a relative term subject to management plans, to the vagaries of military manoeuvres, to the location of Winter Olympic Games sites, and to the increasing pressures of the "urban nomad" seeking a "wilderness experience."

Clearly our views of each one of these scenes and the understanding that we bring to them will affect the range of management strategies and design agenda that we consider appropriate to the symbolic, cultural, social, and biological contexts that they represent! This concept is reinforced in the literature, philosophy, and

history of our idea of nature. The paradigms that they represent form the backdrop against which the landscape, development, and the planning and management necessary to assure its sustainable and equitable use must be understood, and ultimately evaluated both in the South and in the North.

IV. Planning Strategies and Shifting Paradigms

One of the most fundamental characteristics of planning is the intellectual and cultural setting that supports the process. Not surprisingly, a significant distinction between traditional and Western cultures is our understanding of time and of space (Eliade 1949).

In Australian aboriginal cosmogony "Dreamtime" is central. Heroes come to a featureless world and transform themselves into natural phenomena, such as trees and rocks which have sacred meanings associated with the particular heroic figures, thus creating the landscape. The Dreaming, when things are made, is not just in the past but also in the present. All space is here, all time is now.... Besides having a different concept of time aborigines also see space differently. It is not something measured, it is an area whose use is dictated by custom. *"Every yard is known — but not its size"* (Rapoport 1977).

In our South, space has been divided and subdivided since the first military engineers from Europe set foot in North American soil over 400 years ago. Land surveying an land division is a normal part of our view of the space that we inhabit. The theory of land-use planning relies heavily on the premise that difference spaces can and should be used for different activities.

How applicable are these concepts of spatial division and the subsequent allocation of designated uses to our North where space has not been characterized by its divisibility, but rather its extent and continuity? How much more difficult is it to trace lines on a territory where the distinction between land and water varies so radically from winter to summer, and when we know that spatial segregations of northern and southern waters are predominantly vertical. Can we design appropriate planning methods and development activities that are supportive of the reality of the North as it is perceived?

Development, regardless of scale implies change. Change may create deep and disturbing issues, issues that will require different planning strategies to achieve a sense of resolution with respect to the transformations that affect a given community. Confronted with change we all seek ways to exercise a measure of control over these events in order to assure that they are somehow congruent with the perceived images and needs of the community and its individuals (Jacobs and Kemp 1986).

The need for development to meet basic human needs and for local initiatives and self-reliance to be respected and promoted (Cocoyoc Declaration 1974) are amongst the key issues raised under the banner of "eco-development." The participation of indigenous peoples in the development process has become an increasingly important focus of concern (David 1984), and many groups of indigenous peoples are formulating their own development strategies. The inter-relationship between development and Inuit culture has been formally addressed by the Inuit Circumpolar Conference (ICC). A resolution submitted and accepted at the third general assembly of the ICC held in Iqaluit (Frobisher Bay), Northwest Territories (ICC 1983) stated in part that:

> The circumpolar region, its environment and its resources are of fundamental importance to Inuit and the global community; Inuit recognize their special responsibility to manage and protect the environment of the circumpolar region for the benefit of present and future generations.

The shift in planning strategies (paradigms) from a centralized, detached top/down approach to the organization of our future to one that is local, involved and generated from the bottom-up was initiated in large part as a means of responding to the issues raised in earlier sections of this paper. Our image of the landscape, our ideas of its use and management are intimately linked to the knowledge networks of our culture, a network that is constantly changing, some-

times dramatically. The paradigms that we use to explain these cultural/environmental phenomena to ourselves shift as a consequence. Nor are the shifts understood or interpreted in the same way by all those affected, they are certainly not universally accepted (Baffini 1985).

Some of the problems associated with these shifts include the fact that:

— some paradigms are rejected by decision makers (and other sectors of society) who resist change notwithstanding continued and demonstrated weaknesses in using these paradigms to achieve stated goals and objectives. Continued poverty and environmental degradation in the first and third worlds for instance have not responded well to centralized, normative planning proposals.

— some paradigms fail based on the belief that what is rational and valued in one setting will be viewed in a similar manner in another. Schumacher described as "scientific imperialism" the assumption that the transfer of rational explicit scientific methods would necessarily benefit traditional cultures (Schumacher).

— some paradigms are perverted or are manipulated for purposes not originally intended. Self-reliance that is created and supported from the centre through elaborate administrative and financial procedures is unlikely to be sustainable.

— some paradigms are misinterpreted as may be the case where "self-reliance" is assumed to be material self-reliance based on a relatively limited number (200) of nation states regulating their activities through financial and trading institutions. When self-reliance is seen as a cultural goal however, the more than 2000 sub-cultures and 5000 linguistic groups of the world pose an entirely different problem.

— some paradigms are insufficiently attractive to attract allegiance; self-reliance and the satisfaction of basic human needs may be perceived as second class status relative to the image projected by the industrial consumer society. Many of the younger elite of the developing nations, and nations within nations, have rejected the image of herbal medicines and romantic communes as an insufficiently attractive goal.

Irrespective of the problems inherent to the shift from one planning paradigm to another, it should be recognized that most paradigms are idealized and abstracted concepts that are useful if and only if they help to inform the knowledge networks described in this paper. Centralized normative planning as well as bottom-up approaches to self-reliance exist because and in spite of each other and will probably continue to do so.

VI. Towards a Northern Praxis of Research, Management and Planning

What may well be critical in the search for a sustainable and equitable future, particularly in the North, is not so much a paradigm shift as a shift of praxis where power is both devolved and decentralized. It is likely, however, that shifts in both our paradigms and our praxis will be required if we are to achieve sustainable and equitable development. Some modest examples of these changes in Northern Quebec are suggested as initial and, I believe, successful examples of this shift in praxis, a shift that contributes to and informs the paradigm of sustainable and equitable development.

1. Research into ecological knowledge and land-use

The purpose of this research project in Northern Quebec is to provide a precise information base on past and present land use based on the extensive knowledge of hunters (Figure 1). The methodology is complex and the long-term field work, intense. Information is gathered by individual and group interviews that can last many hours. Interviews result in the creation of individual hunter maps by species, season and time period; as well as in ecological maps for individual species that are supported by written descriptive notes and taped interviews. All of the information is compiled on mapping computers according to special programs written to accommodate the data and to produce maps and descriptive texts in Inuktitut. The research is being funded by Makivik Corporation because Inuit feel that they should have primary access to the information and its interpretation.

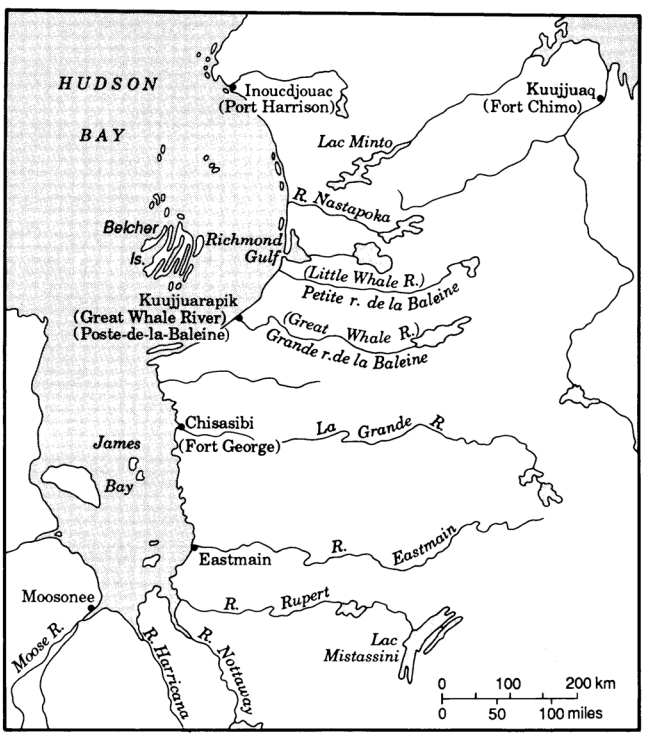

Figure 1. Cree Lands in Northern Quebec

The project records all information on the historical and present-day land use of Northern Quebec hunters, and enables Inuit to make very detailed maps of their hunting territory, travel routes, living sites, archaeological sites, and any other place that is special or important. It records the traditional knowledge of Inuit about the movement and behavior of all of the animals, fish and birds, and is supported by written documents based on Inuit knowledge about and experience with all of the important species.

Finally, the project records Inuit knowledge about the physical environment of northern Quebec. This includes: information about the sea, sea ice, fresh water, and land. It shows what happens to each of these environments in the spring, summer, fall and winter, and locates and explains dangerous areas and any other information about the environment that the Inuit think is special or important for any reason. The project is well advanced, and has already been used to support a number of Inuit initiatives in northern Quebec. One such initiative deals with the need to conserve and manage the beluga whale population along the eastern shore of Hudson Bay.

2. *Managing wildlife*

Wildlife populations in northern Quebec are not endangered, but do require comprehensive management policies and programs to assure the greatest sustainable benefit to present generations while maintaining their potential to meet the needs of future generations. An extensive wildlife management policy and program for northern Quebec has been developed by the Makivik Corporation that focuses on "the need to manage Northern resources according to principles that are understood by Inuit and according to methods that are compatible with Inuit values and lifestyles" (Kemp 1983a).

The management program is designed "to develop a comprehensive approach to management that includes the biology and ecology of resources for subsistence, non-consumptive and, when warranted, commercial purposes." The objective is to determine a strategy for management that will enable Inuit to identify and maintain healthy wildlife populations, to identify geographic areas or species populations in which problems now occur so that management solutions can be established, etc. Much of the management program is of course based on the ecological knowledge and land-use research.

In this regard an agreement between the municipalities of Kuujjuarapik and Inukjuak and the Anguviak Wildlife Management Inc. to enforce the conservation of the beluga whale stock which breeds in the Little Whale River, Richmond Gulf and Nastapoka River along the eastern shores of Hudson Bay is of considerable interest. The parties agreed, among other items, to the following:

— That no female beluga whale which carries its young on its back or nearby it while swimming shall be killed intentionally when assault on beluga whales takes place during the whale hunt.

— No shooting will be allowed until the whale has been harpooned first before it can be shot at and killed.

— Anyone who kills the beluga whale(s) must report their kill to the local wildlife management group who shall keep track of all whales harvested.

— All hunters will be asked to take all that

can be carried of the edible whale meat back with them when they go back to their communities.

Information is essential to the development of a wildlife management program. In the case of the beluga whale agreement, the ecological knowledge and land-use research project based on Inuit knowledge of the region supported by various other scientific activities associated with potential hydro-electric development of the coastal rivers resulted in a system of problem solving that allowed an effective integration of these two types of knowledge. It is significant, however, that the management agreement was generated in the North for the North, and inevitably for the South as well.

The importance and comprehensive nature of wildlife management requires that biological resources be integrated into all phases of northern planning including coastal zones, river basins, and specific land, wetland, and fresh water habitats.

3. *Planning for a sustainable and equitable tomorrow.*

Martin Holgate points out in his introduction to the book *Adaptive Environmental Assessment and Management* (Holling 1978) that "because of uncertainties, environmental science can be used to guide the development and management of natural resources only if there is a continuing interaction between the scientist and the manager." He further suggests that "the dialogue must continue throughout the development process because of the uncertainty of predicting impacts at the beginning; for this reason also development plans need to be designed in a manner that admits of some flexibility so that they may be adjusted to make the best use of the environment." In northern Quebec, the Kativik Environmental Quality Commission (KEQC) represents an evolving institution that may well be initiating the dialogues to which Holgate refers.

The mandate of the Kativik Environmental Quality Commission is to review and assess the environmental and social impacts of projects proposed north of the 55th parallel in the province of Quebec. Upon review, the Commission decides whether or not to authorize a project and, if a project is authorized, under what conditions it should go forward (KEQC 1981-85). This constitutes a radical departure from the more traditional advisory role typically accorded Native or joint Native and government boards, committees and commissions.

The composition of the Commission was designed to achieve a balance of judgement, values, perception and knowledge between Native and non-Native participants: the North and the South. The Commission functions, in fact flourishes, on the variety of expertise that its members have acquired and the distinction between Inuit knowledge and southern science has seldom if ever been drawn. Further expertise on issues of concern to the Commission can and has been commissioned (Kemp 1983b) as in the case of the hydro-electric project proposed for the Great and Little Whale Rivers. The integration of information and even of types of understanding inherent to the two cultures, has allowed the Commission to find ways of dealing with projects in a manner that was clearly not foreseen when the mandate of the Commission was originally developed.

Consider the following example: municipal services in the communities of northern Quebec have been, until recently, less than adequate. Some community landing strips occur at the edge of cliffs, others are graded to slopes that would bring fear to the most hardened traveller, still others are located in the middle of town. The "solid waste disposal site," an eloquent name for what is often an exposed, poorly defined, garbage dump filled with "honey bags," is located in the middle of some villages. Requests for improved or new municipal infrastructure are forwarded to the Commission for review.

The Commission is encouraged to act quickly for obvious reasons! In fact, a completely different strategy was adopted. The Commission asked the municipalities of what use would it be to approve a solid waste disposal site up-stream from the fresh-water intake? How could it approve the location of a new bio-disc sewage treatment plan without a knowledge of the location of the road access to a new airstrip that might be built at the same time?

Reaction was immediate and conclusive.

People who had lived with wind-blown garbage in their living-rooms and front yards didn't have time to waste. They didn't have time to repeat costly errors either. A strong level of agreement was achieved to re-submit projects in such a way as to foresee the interrelatedness of each of the critical components. The interdependence was quickly grasped in the villages and a common strategy designed for the location of each of the components of an integrated system of village services.

The institution represented by the Commission has learned to learn, and has encouraged others to do so as well. An institution originally designed to evaluate projects at the end of the development process has evolved into one that encourages environmental planning at the beginning.

The Inuit of Northern Quebec recognize that they have a rich intellectual and cultural base from which to derive knowledge, and they also have traditional ways for applying this knowledge to questions of planning. The challenge in today's world is to reinstate the importance of their knowledge within an adaptive planning process.

It is not at all evident that willingness to seek sustainable and equitable development will, *a priori*, result in innovative and appropriate policy, strategy, and tactics for the use and management of the North. In fact, the application of planning methods and techniques derived from southern Canadian experiences may well aggravate rather than alleviate problems related to the future use and management of the North. This is particularly true if such a venture is not truly adapted to the people and the place for which it is intended.

At stake is the design of institutions and decision-making processes that recognize all four of the North/South networks of knowledge. In order for our responses to this challenge to be meaningful and appropriate, we must be innovative. *We* cannot rely on the theory that those formulae developed in one context will necessarily be suitable in a context that is distinctly different or unique.

Whereas our southern and northern people and traditions are neither inferior nor superior; they are different. If we plan, we must do so with as full an understanding of these differences as possible and with an astute sensitivity to the range of values that underlie these differences (Jacobs 1981a).

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Inuit Art, The Past Twenty-Five Years: Aesthetics, Transformations and Categories

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Introduction

The purpose of this paper is to survey the range of Canadian Inuit aesthetic productions and the changes they have undergone in the past few decades and hence to examine the contrasting perspectives of Westerners and Inuit towards these productions. A related objective is to analyze expressions of Inuit culture as our term "art" is applied to them and thereby to contribute to our understanding of the strengths and weaknesses of the cross-cultural use of the term art.

In contemporary scholarship on the anthropology of art the influence of commercialism on creativity is hotly debated, both in the contexts of Western and non-Western art. In his book *The Gift: Imagination and the Erotic Life of Property* (1979) Lewis Hyde argues for the mystical interpretation. According to Hyde "the production of every work of art entails some degree of resistance to the dictates of the marketplace.... The spirit in which an art object is created differs from the spirit in which objects are produced intentionally for profit on the market. The artist is ruled by the spirit of gift exchange even if his or her work is later bought of sold.... They are *intended* for personal gain, but rather produced by an almost mystical need felt by the artist" (synthesized in Dominguez 1986:553).

In diametric opposition to Hyde's romanticized interpretation is Jaques Maquet's (1971) more pragmatic claim. Following Malreaux (1947), Maquet argues that art is a conceptual category restricted to stratified civilizations. He takes the position that objects become art in one of two ways, either by *destination* (when the intent of an undertaking is "art" *per se* or has a primarily aesthetic locus), or by *metamorphosis* (the process whereby an aesthetic object is labelled "art" at some moment after its creation; the transformation occurs either through historical events or when the object crosses cultural boundaries). Maquet asserts that "art" consists of all that enters into the circuits of the art world, the world so acutely analyzed by Becker (1982). Therefore, Maquet concludes: "Outside our showcases, there is no primitive art, particularly not in the non-literate societies where museum and gallery objects have been created" (Maquet 1971:16).

The most widely recognized Inuit art forms are soapstone sculptures and graphic prints. Made for sale to white people, who classify them as art, the carvings and prints on leaving the North immediately enter the art circuits of the modern world. Paradoxically, however, the Inuit language has no concept comparable to "art." The Eskimos call these creative productions *inuit sanasimajanga*, a phrase meaning "things made/done by Inuit," without reference to their internal or external consumption or to the sources of their "artistic" traditions. Of course, the Inuit can and do label all kinds of productions, novel or traditional. Indeed, their flexible, polysynthetic language is capable of great accuracy (see Graburn 1965 on Inuit linguistic acculturation), but none of their terms carries the connotation of "art." Consequently the term itself, and the classificatory scheme discussed here, would mean little to the people who created the objects in question. Despite this

irony, the Inuit continue to be among the most creative of the world's peoples. One of the most consistent characteristics outsiders have noted about them is the pleasure they take in the creation of beautiful and finely crafted objects and their delight in song, dance, and story telling.

Given the discrepancy of cultural attitudes toward Inuit art, where are we to situate it in relation to Maquet and Hyde's contradictory assertions? An ancillary question of equal significance is what the investigation of Inuit art reveals about our definition of art and how we view it as a conceptual category.

In Inuit art scholarship there are two approaches to the uncomfortable relationship of creativity and commerce as diametrically opposed as Hyde's and Maquet's. Edmund Carpenter is the chief proponent of the thesis espousing the "special" or mystical nature of Inuit art. In his book *Eskimo Realities* (1973) and elsewhere, Carpenter has argued that the market orientation of prints and soapstone carvings excludes them from consideration as Inuit art. He takes this position because, he says, these art forms were invented by non-Eskimo civil servants, anthropologists and entrepreneurs for the purpose of supplying a commodity for the southern market, a commodity which, in turn, provides a source of income for the colonized and pauperized Eskimos. Carpenter goes so far as to liken Inuit commercial arts to the plastic Jesuses made by New York Jews for consumption by Christian car drivers.

George Swinton (1965, 1972) is the main proponent of the more pragmatic approach. He and other art historians, entrepreneurs and civil servants echo Maquet's position. Quite unreflectively, they approach the Eskimo sculptures and prints as art, because they are handmade and because they bear a formal resemblance to Western art traditions.

Analytical Framework

The body of this paper surveys the spectrum of Eskimo aesthetic productions, those made for local consumption as well as for export. My aim here is to demonstrate that in intent, life history, and formal quality, the so-called commercial arts can only be understood with respect to their traditional counterparts, and further, that these arts are meaningful tc the Inuit as well as to Westerners, although the meaning is qualitatively different.

The framework of my discussion is the analytical scheme I have developed (1976, 1984, 1985) for the general study of non-Western arts in contact with the world system. Since Inuit art is such a cross-cultural phenomenon, the scheme delineates the channels through which these arts move back and forth across cultural boundaries.

This framework has been developed out of a comparative examination of the world's contemporary "primitive arts" — usually made for sale or, if not, subject to the widespread world market for such objects — resulting in an attempt to classify the various artistic genres according to two dimensions. (See Figure 1.) These are (1) the *destination of the artifact*, having the two values (a) the local or ethnic society, i.e., made for local use, or (b) the outside, world society, reached through export or purchase by visiting tourists; and (2) the *sources of the art forms* themselves, with, heuristically, three values: (a) the local or traditional "ethnic" community, (b) national or international genres (of already existing world arts), or (c) novel or synthetic sources, resulting from the unique inter-cultural situation. Thus we have a matrix with six labelled "boxes" each presenting "arts" which differ according to source of form or ultimate destination. The reader *must* bear in mind that here we are not talking about a historically graded set of genres but about the simultaneous production of different forms.

What has come to be known as Eskimo or Inuit art in Canada — in the plethora of collections, publications, exhibitions — obviously falls into the right hand side of the diagram, i.e., things intended for the market, and Inuit art falls into two boxes on that side, "Souvenir/ Novelty," which includes models and sculptures made of a variety of materials, or "Assimilated Arts," the various traditions of the Western arts world which have had to be taught to the Inuit, e.g., print-making and weaving.

Inuit contemporary arts did not spring up in a vacuum. Most bear relationships of one sort or

Types of Inuit Aesthetic Productions

Source of Form and Style	Intended Audience: Minority Society	Intended Audience: Outside World
Local Traditions	Functional/Traditional Clothing, toys, dolls song and dance, hunting and household equipment, etc.	Replica/Commercial Hunting equipment Music records, Song performances etc.
Novel/ Synthetic	Reintegrated Clothing, duffles Dances (reels) Church music	Souvenir/Novelty models, miniatures, Cribbage boards, Carvings, jewelry, Dolls, clothing
Outside World	Popular Arts Music (guitar) Dance (Rock & Roll) Home photography Clothing	Assimilated Prints, painting Weaving, pottery Jewelry

(after Graburn 1976: 8)

Figure 1. Types of Inuit Aesthetic Productions

another to earlier types. Consequently, in my opinion, the nature of contemporary arts can only be understood by reference to *all* aesthetically important productions of the Inuit and to the historical transformations between (and within) these categories. Figure 1 indicates other recent and contemporary productions of the Canadian Inuit, especially those of continuing importance to Inuit society. This analysis of categories and transformations connects both those arts made for the Inuit themselves and those made for the market.

Types of Inuit Aesthetic Productions

Traditional / Functional

If we examine the material and aesthetic productions of the Inuit over the past 40 years or so, we can see that all major types of aesthetic productions have been present at any one time, though their presence has varied from area to area, and their relative proportions have changed during that time period.

The material culture of traditional and contact-traditional Inuit life was mainly functional in the utilitarian sense, because the Inuit had to *work* to survive the special conditions of their environment. Yet, such supremely adapted items as hunting equipment and igloos had their aesthetic attributes; they were often made with a care that equalled the contemporary "arts by destination." Indeed one might say that their combination of superb proportion with visible, functional materials and construction, was almost *bauhaus*. Even objects of daily use such as buckles used to fasten dog traces, ulus, scrapers, knives or bow drills were made with a care beyond that required by their humble purposes, and many, especially the archaeological specimens, have become "art by metamorphosis" in our present displays (e.g., Wardwell 1986).

Clothing

Amongst the most important and universal of Inuit productions was traditional skin clothing. Their aesthetic dimensions have been largely overlooked by *gallunak* (white men's) institutions where the commercial arts are so frequently presented (however, see Driscoll 1980). Though hunting equipment and igloos show regional variation often as a consequence of environmental constraints (Rousselot 1983), clothing showed immense regional variation in spite of the relative uniformity of climatic and utilitarian requirements. One could almost say that the aesthetic and symbolic aspects of skin clothing — expressing ethnicity, regional identity, sex, age and status — were as important as their ingeniously efficient construction. The same could certainly be said about the less utilitarian items of personal use, e.g., needle-cases, talismans, combs and coiffures.

Games and Toys

The Inuit also made an array of small artifacts for recreational purposes. For adults there were various games (cf. Myers 1980:157-165) and the ubiquitous ivory *tingmiujak* bird/woman figurines, often used for gambling. For boys there were small ivory and stone figurines of animals and birds on which to practice marksmanship, the *pinguak*. It was these that served as the prototype for commercial soapstone carvings of the twentieth century. For girls, there were small, often armless dolls, usually made out of wood, dressed in simple play clothing (Photo 1). Some of these toys and models may also have served as grave goods, being

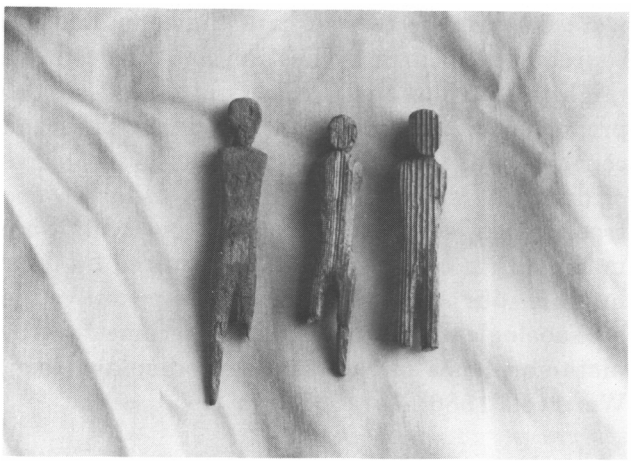

Photo 1. Traditional wooden dolls for girls; found in old house sites by Jimmy Manning, Cape Dorset, 1986. [EB.19.14].

placed beside the deceased to accompany the soul to the next life.

Song and Dance

As is commonly the case with nomadic peoples, the most important aesthetic expressions to the Inuit were the intangible, ephemeral arts of song, dance and story-telling. These required paraphernalia such as drums, but for the most part the mobile Inuit carried their arts in their heads, and expressed their community solidarity through performances in which both men and women took part. Traditionally the men were drummers, vocalizing or singing during their dance performances. Women provided the choruses for these events, dancing with a slow shuffling and/or singing refrains (*aajaijai* songs) or through polytonic word songs (*pisirk*). Such songs (*pisirk*) could also be sung by men or women within the family or at any gathering.

Verbal Arts

Story-telling (*unikkatuak*), song contests (*illuriik*) and shamanistic performances (*angakungnirk*) were as much for entertainment as didactic or efficacious. These "verbal" arts involved the performer — more often men than women — in creative imitation of other humans, ancestors, spirits, birds and animals, in which they "became" the role being played — much to the joy and amusement of the audience. Even shamans' performances were not always received with utmost seriousness (characteristic of Christian rather than other religions) and were often an eagerly awaited form of community recreation.

Replica/Commercial

One result of increasing contacts with the outside world — and all Inuit groups were in some sort of permanent, dependent contact during the period under consideration here — was a proliferation of aesthetic forms, both tangible and intangible. Ever since the beginning of the contact period, Inuit-*gallunak* relationships have included aspects of commercialism, among them the outsider's desire to purchase objects of Inuit manufacture as souvenirs. Though trade of traditional utilitarian items has always been common, at any one time there were only limited numbers of objects suitable as souvenirs available. Thus the Inuit began making *replicas* of traditional items — umiaks and kayaks for example (cf. Arima 1963, 1964; Guemple 1967) and hunting equipment, clothing, games — for export to the museums and private collections of the white world. As the Inuit have become nostalgic about a past that lives only in the memory of the older generation, some of these replicas, the functional originals of which may no longer be made, are now finding their way back in travelling exhibits (Myers 1980) or in recently constructed museums in the North.

Song and Dance

Replica versions of Inuit non-material cultural performances are also becoming common. Traditional singing, drum-dancing, and *kajjatajuk* (throat singing), as they are forgotten or cease to have functional social relevance in the North (Karlinsky 1986) are increasingly performed for researchers and outsiders on special occasions, and at cultural events in the South and on international tours. These are replicas or reproductions of the originals in the same way as are the umiaks and kayaks at various times commissioned for the National Museum of Man, Ottawa. But, as with

the above-mentioned items of material culture now seen in the North, the nostalgic turn of the present era increasingly introduces such "traditional" performances (and reproductions of performances in Inuit television) into northern communities for different, identity-maintaining functions.

One might almost say that the records, video and audio-tapes of these performances (Pelinsky 1979) are replicas of a sort which function outside the traditional context.

Souvenirs / Novelty

The interaction of Inuit peoples and the outside world soon led to the production of *souvenirs*. At first these usually took the form of miniature replicas, i.e., models. While some of these may have been models already made as toys or grave goods, in the past half-century the models were specially made for export, both to visitors who commissioned them and as part of the "arts and crafts" trade. Most *gallunat* do not wish to have full-sized kayaks, weapons, or even skin clothing as souvenirs and the Inuit have been quick to respond with miniatures (Photo 2). Even so, some of them complain that it's as much trouble to make small versions as full-sized replicas. Whether souvenir models are "counted as art" or not, we should bear in mind that they may lack "authenticity" of a sort, but nonetheless display the same aesthetic attention paid to the originals. Claude Lévi-Strauss (1964) has pointed out that miniaturization is a creative manipulation of reality and a vital ingredient of some forms of art.

Models

In the extended cultural interface between the Inuit and *gallunat* world, the production of souvenirs has long since gone beyond realistic models. Until about 1950 such models depicted Inuit life as it was actually lived — showing guns, chairs, cloth-clothing, metal traps. These subject matters have given way to others, specifically tailored to the demands of outsiders. Whites have commissioned objects such as ivory cribbage boards, chess sets, pie-crimpers, or rings (for fingers). Although these prototypes are non-traditional, they are made by the Inuit in

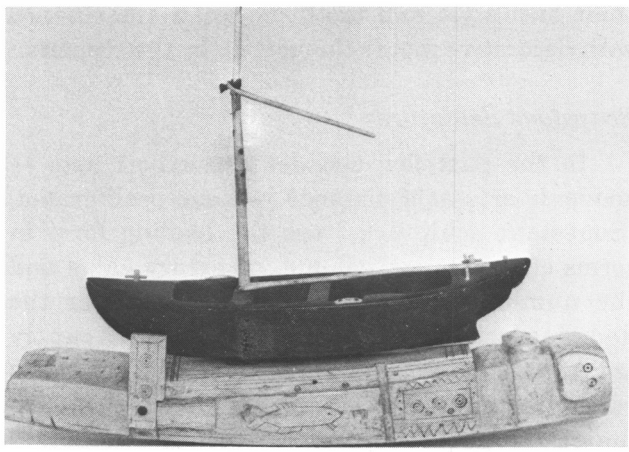

Photo 2. Old style souvenir model: soapstone whaleboat on carved ivory base; Lake Harbour, NWT, 1940s. Private collection [WB.1.9].

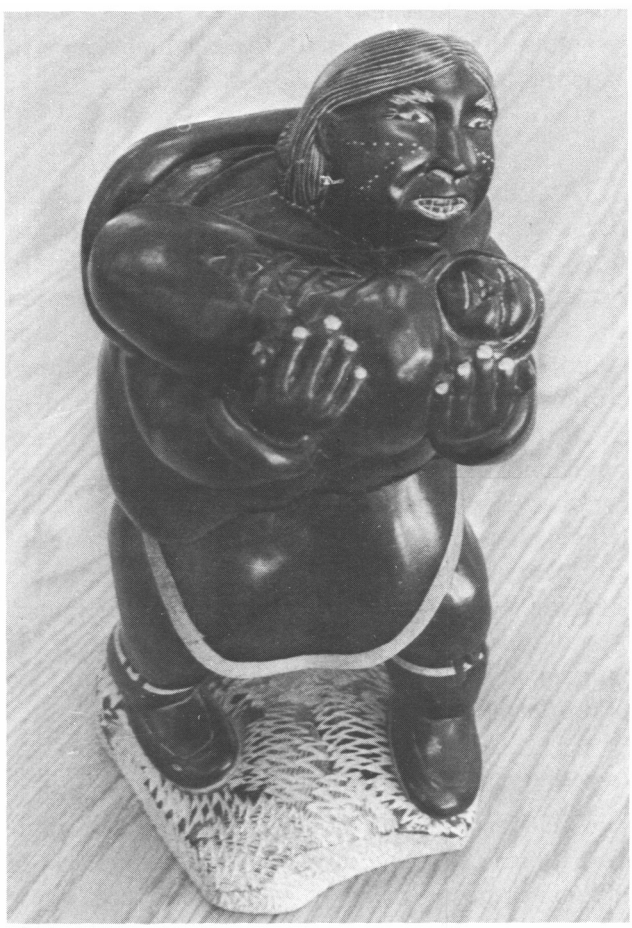

Photo 3. Soapstone sculpture of woman and child in traditional clothing. By Thomassie Sivuarapik, Povungnituk, 1985. Collection of Inuulissivik Hospital, Povungnituk, PQ [EB.24.10].

their own style and methods, often embellished with decorative motifs thought up by the creators.

Soapstone Sculptures

In the past few decades the export arts — souvenir arts at a distance — have proliferated. "Soapstone sculptures" are the leading form in terms of production volume, monetary value and the number of participating artists. Over the decades, these arts have significantly transformed from their prototypes, the *pinguak* souvenir/miniatures of former decades in two major respects. First, unlike the original models, the newer renditions usually represent "life as it was," idealized recollections or actual phenomena, rather than "life as it is" in the contemporary Inuit world (Photo 3). Second, in scale and form, these sculptures have come to resemble the Western sculptures which move in the same mainstream world art circuits.

Dolls

The Inuit make dolls of various types for the marketplace. These are not the traditional *inujak* dolls for little girls. Some are true Novelty forms, for example, the "packing dolls" invented in Spence Bay, or the clothed wooden-bodied or soapstone-headed dolls from Pangnirtung, Inujjuak and Cape Dorset. Most are clothed in miniature versions of traditional or near-traditional Inuit styles. Indeed, model clothing, itself a saleable souvenir item, replicates the attractiveness and ingenious construction of Inuit attire, particularly the miniature boots (*kamik*s). Other examples, such as the Holman Island "puppets" emulate the dolls of non-Inuit peoples of North America, thus qualifying as Assimilated forms (see below).

Jewelry

Another common souvenir art/craft is non-traditional jewelry, commonly (finger) rings and earrings of ivory. These items may show minimal decoration or may incorporate figurines that serve the souvenir function of the Arctic people or their environment: for example, seals, walruses, bears, birds' feet, etc. Such jewelry is usually produced by non-specialists in the home or normal workplace and differs from the more "industrial" type of jewelry produced with specialized machines in workshops (see below).

Reintegrated

Probably the major category of functional arts among the Inuit today are those I have called "Reintegrated." Like Novelties, the principal criterion of these forms is that they have been invented or adapted for use by the Inuit themselves in the contact situation. In time Reintegrated art forms become the new Traditional forms; they may in turn undergo further transformations which would reclassify them as Replicas or Souvenirs.

Clothing

Paramount among Reintegrated art forms is the clothing Inuit women make for themselves and their families. In the past 30-40 years, clothing made of imported materials but designed along the lines of the traditional fur and skin clothing has predominated among all but the wealthiest and most urbanized Inuit. Common examples are the familiar duffle and cloth two-layer parkas, both the peaked style made for men and the *amautik* made for women and sometimes for young girls (Photo 4). Cloth trousers are occasionally made, though they are usually replicas of imported styles.

Duffle inner socks have replaced caribou-skin liners for traditional skin boots or imported footwear. Hats are another archetypal category of Inuit manufacture, especially crocheted toques made of imported wools. Used by men and women, and even worn inside parka hoods, they are decorated with designs of local invention. Local design motifs, differentiating people of different regions or even families, are an element common to all reintegrated garments: crocheted hats, parka trim and embroidery, and the wool embroidery around the top of duffles.

Music

Other spheres of expressive culture have been characterized by reintegrated forms which bear little resemblance to either traditional or

Photo 4. Reintegrated cloth parka worn by Cape Dorset girl, 1986. Photograph by Valerie Chaussonnet. [EC.14.33].

imported forms. Music is one example. By the end of the last century, whalers, sailors and traders had introduced reel-dancing and the accompanying music to the Inuit of the Eastern Arctic; shortly thereafter, the Inuit had invented their own versions. Some musical instruments such as the accordion were assimilated directly, but others were reinvented in uniquely Inuit form; the violin, which re-emerged as the *tautirutik,* is a classic example (Photo 5). The music accompanying dancing and entertainment using these instruments was distinctly different from the imported prototypes.

The history of Inuit church music closely parallels that of reel music. Early in this century Christian missionaries introduced hymns and psalms (and later organ music), but the Inuit

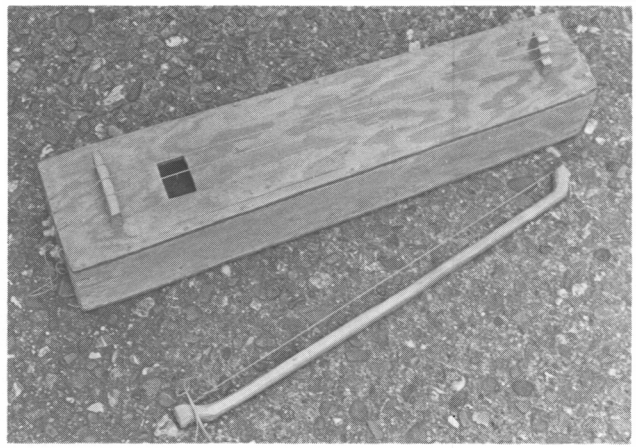

Photo 5. Reintegrated musical instrument: "Eskimo violin" (tautirutik), Ainilik, Ivujivik, PQ, 1964. Private collection.

catechists have significantly transformed the tonalities and rhythms of the standard Western renditions, sometimes almost beyond the point of recognition.

Popular Arts

In the past decade, through wholesale incorporation of the material culture of the outside world, Inuit expressive culture has come increasingly to resemble it. I have labelled artifacts in this category Popular Arts (Graburn 1976:7-8; cf. Szombati-Fabian and Fabian 1976) in reference to the tendency of the Inuit populace to integrate products from Canadian culture into their own way of life. The term is differentiated from Assimilated Arts (see below) only in that the latter are made for export.

Clothing

Today, most Inuit wear clothing purchased from local stores. Generally, these are the standard work and leisure wearing apparel of the world market; increasingly, work and sports clothes designed specifically for use in cold climates are among them. Often these clothing items are worn in combination with the traditional Inuit *kamiit* but even here, manufactured boots are now are worn for most outdoor activity. Most recently there have been a few efforts at representing regional or ethnic identify by means of T-shirt logos, sports team emblems

etc., but these are made by outside companies.

Among the younger generations, personal adornment, like clothing, usually follows outside fashion; for example, punk rock accoutrements were popular in 1986. Creative adaptations of these styles enliven the popular culture of the contemporary Inuit. Hairstyles not only follow outside fashion, but can now be obtained at home from Inuit professional hairdressers, who use imported ideas and equipment in their work.

Photography

Another Popular art form with profound meaning for the Inuit is photography. First introduced in the late 1930s, it was here that Peter Pitsiulak made his mark as an innovator and recorder (Pitsiulak and Eber 1975, Graburn 1979). Owing to the local unavailability of photo processing, photography was not widely practised until the coming of regular air services in the 1960s.

Soon thereafter the Inuit began to acquire cameras. The Inuit have always derived a remarkable amount of satisfaction from looking at photographs and sharing them, possibly because they foster a sense of group unity with those who are absent. At first, snapshots were stored in envelopes to be passed around, lost, torn, chewed or written on by the children until their entertainment value was gone.

During the 1970s the Inuit began to keep their own photos (and those sent to them by others) in well-thumbed family albums. Additionally, photographs, framed and unframed, have become part of the household decor — usually family scenes or hunting activities. In the past decade many have developed sophisticated techniques, composing their images with an eye to eventual display. Some, such as Jimmy Manning of Cape Dorset, have even become professional photographers, selling images for mass production in books and calendars, (thus qualifying their output as Assimilated rather than Popular arts). The tendency to regard photographs as permanent possessions has abetted the growing historical consciousness of the Inuit. Today, old photographs of family members and camp life — often from publications and non-Inuit photographers, are assuming a place of honor in Inuit household decor.

Music

Popular music is a lively medium of Inuit cultural expression. Records and tapes of modern popular music are common in most households, including those created by the Inuit themselves. Nearly every community has musical groups which perform publicly — rock, disco, country and Western — and some Inuit have become well-known composers and vocalists, accompanying themselves on the guitar. Though the guitar (and other instrumental music) is imported, the language, lyrics and style of the songs are very much part of Inuit contemporary culture. These songs may be of local relevance, to amuse the family or community, or they may bear upon the modern predicament of being Inuit (Photo 6). The latter are often of political relevance and reach wide audiences via radio broadcasts, at regional, national and international meetings organized by such groups as ITC and ICC, or through commercially-distributed recordings.

The hegemony of popular music has not excluded the prior musical forms, however. Traditional musical genres — drum dancing, throat-singing, *pisirk* — as well as historically Reintegrated forms — accordion reel music, "folk" fiddle playing — also enjoy local and widespread audiences, especially as a "desperate nostalgia" for the recent past rises within contemporary Inuit culture. These forms, too, are played internationally and recorded for sale, and indeed may be considered Replicas of their former selves.

Assimilated Arts

Much of what is called Inuit art in the world today is a very specialized portion of Inuit cultural expression: that part which utilizes the format and techniques of what are already recognized as "art" in the outside world, and which are created for exclusive export (back) to that outside world. These are expressions which have little precedent in Inuit culture and which require a social organization of production that

Photo 6. Popular music: Charlie Adams plays the guitar for his family and friends, Inukjjuak, 1986. Photograph by Molly Lee. [EB.27.37].

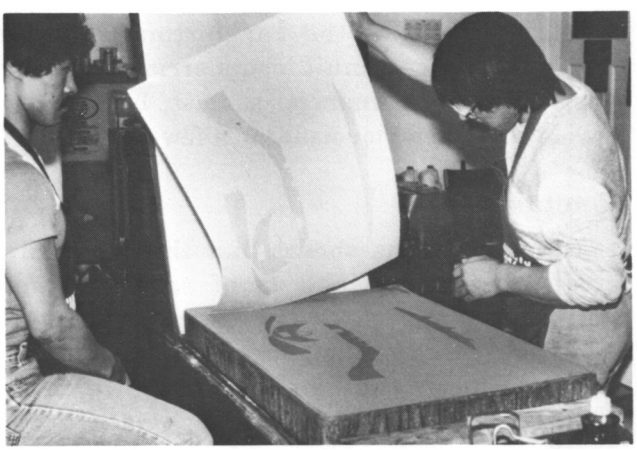

Photo 7. Assimilated arts: Pavvinak and Putuguk pulling lithograph of Pudlo Pudlat graphic, Cape Dorset, 1986. [EC.18.32].

is borrowed or adapted from the outside traditions. Included are the well-known genres of print-making, painting, weaving, pottery making and certain forms of jewelry production.

Printmaking

Print-making is, perhaps, the best known of the "Inuit arts." This may be so because, more than all the other forms, it corresponds to a particular Western notion of "art," involving such variations as stonecuts, stencils, copper-plate engravings, etchings, seriographs and lithographs, and features such as limited editions, annual productions and catalogues (Photo 7).

Inuit print-making started in Cape Dorset in 1957, at the instigation of James Houston (1967) and was soon routinized into the "Japanese model" separating the "artists" who do the drawing on paper and are paid by the piece, from the trained print-makers, who are salaried workers. This model was followed, in order, by Holman Island, Baker Lake, Pangnirtung and Clyde River, but the original stimulus was side-stepped in Povungnituk (starting in 1961) where, for more than a decade, the "artists" cut their own blocks which were later printed by specialists. In a sense the "artists" who have not been trained in Western art history or techniques, are producing what is a Souvenir/Novelty (a new form, made for sale) whereas the print-makers and the overall process are Assimilated Fine Arts (a Western technique, adapted by the Inuit for commercial purposes).

Painting

Painting, the related two-dimensional art form, is uncommon in the Canadian North. We know that Peter Pitsiulak tried water colours under the influence of John Buchan (1955). Occasionally other *individual* artists have obtained watercolours, pastels and oil paints from visiting white artists, school teachers etc. For example, Peter Naujak of Rankin Inlet, Simon Qitsualuk of Povungnituk (and later Akulivik), Eddie Witaltak of Kujjuarapik (Great Whale River) have achieved limited success. Their occasional works have been bought by local institutions (the school, the cooperative, and the airport respectively) and, rarely, by white buyers. A handful of artists — Henry Ivaluakjuk of Iqaluit (Frobisher Bay) and Davy Atsialak of Cape Dorset, for example — have painted more regularly and enjoyed considerable success, possibly because their work is more attuned to the southern taste and their market relationships are more typical of the mainstream art world.

In contrast to all the above are those Inuit artists who have had considerable southern training and exposure, such as the painters Andrea Laureen of Inuvik and Mary Panigusuk

(now of Iqaluit) and the illustrators Alooktook Ipellie and Germaine Anaktaujak, both of whom live in the South and who are fully assimilated commercial artists in their relations of production. One might add that, in contrast to their many confreres in the North, there are two Canadian Inuit sculptors, Abraham Anghik and his brother David Ruben Piqtouquin, who have similarly received training and exposure and work in the southern, assimilated context.

Weaving

Weaving, like print-making, is an organizationally divided art form. The "artists" in Pangnirtung (and previously in Baker Lake too) make drawings (occasionally water colors) which are then selected for translation by imported methods into the thoroughly unprecedented form of tapestries. The latter, like prints, are produced in specialized workshops by a trained corps of technicians (weavers) and are catalogued and sold into the regular art circuits of the South.

Jewelry and Pottery

Two other workshop-based art crafts exemplify Assimilated forms: pottery making and "industrial" jewelry. Pottery-making (the unrelated pre- and protohistoric pottery from Alaska and Canada notwithstanding) was a truly unprecedented but short-lived experimental project devised to use the power from the abandoned Rankin Inlet nickel mine in the 1960s (Greneir 1969). With their prior experience as sculptors, the Inuit easily learned to work the clay and to fire and glaze their unique creations. Despite the appeal of the project to the Inuit and of its results to southern consumers, it was abandoned as financially non-viable.

Unlike the "folk jewelry" mentioned in the section on Souvenir/Novelties earlier, Inuit in the jewelry workshop in Iqaluit require training in complex machine methods and materials, such as metals. Here a corps of young artists make mass-produced ivory earrings, pins and necklaces, and engraved sperm-whale teeth, with industrial drills; also, working under a *gallunak* supervisor, they do a limited amount of metal work (Photo 8). These facts squarely put commercial jewelry making into the Assimilated category. Like the Pangnirtung weaving project and most Inuit commercial art/craft forms, it is not a financial success, but it does provide steady employment for a few specialists.

Photo 8. Industrial-style production at the Jewelry Shop, Iqaliut, NWT, 1986. [EB.10.9].

Conclusion

Our survey has shown that the commonly recognized commercial arts of sculpture and print-making are but two of a large number of past and present aesthetic productions — "arts," if you will — of the Canadian Inuit. Of those surveyed, sculpture and printmaking are the ones "important" to white people, for at least two reasons: (1) They are strictly comparable to already existing genres in the Western art world, a world of non-utilitarian objects circulating at high prices and intended for collection and display; (2) *and*, for the people of Canada, they have been adopted as quickly recognizable icons of Canadian national identity (Graburn 1986). Given that art in itself is not a domain for which Canada is particularly well known, it is especially significant that Inuit art should have come to fill this role.

The particular forms, sculpture and printmaking, appear to follow our Western mainstream rules for the constitution of art. The sculptures, for example, formally resemble Western sculptures: they are made of stone, stand upright on bases, and are usually signed by the artists.

More important, however, is the *subject*

matter of these arts. It speaks to the needs of the contemporary middle classes of modern nations (McCannell 1976); contemporary Inuit art depicts selected aspects of a way of life which is long past, whereas, as we have seen, the early souvenirs depicted life as it was known then. More often than not, sculptures and drawings showing life in the North as it is today are rejected or are rarely offered for sale on the southern market. I would suggest that the romanticized view of Inuit life that white buyers require of Inuit art is at once a reflection of the ambivalence they feel towards the confused and unsatisfactory status of their own societies, and their guilt and regret at having "spoiled" the life of "primitive peoples" through acculturation, commercialism or ethnocide. Thus the perpetuation of an image of the pristine "stone-age" life, through commercially acceptable arts fulfills a fantasy and placates the conscience of our modern age.

For the Inuit, the significance of their commercial arts is entirely different. They have always had a number of aesthetic outlets, the most important of which were clothing and the ephemeral arts of singing and dancing, typical of nomadic peoples. When the demand arose for souvenirs, and later, commercial arts, they attached a different significance to these cumbersome and non-utilitarian objects than did the non-Natives. The Inuit were perfectly willing to trade these objects for the Western goods — guns and ammunition for example — which eased or improved their traditional way of life. They viewed the arts they produced for export in much the same light as the seal and fox skins they prepared solely for the white trade.

Nevertheless, as time has passed the creation of commercial arts has become more significant than mere remunerative activity. Although most Inuit say that carving and printmaking are *inurituksaktuariraku* (the only way I have of making a living), unlike the creation of the *pinguak* toys of former times, artistic activity has moved towards the center stage in these artists' lives. Despite market orientation, these commercial arts embody long-held Inuit values of truth, excellence, gender roles and competitiveness. The Inuit have developed their own strong aesthetic concerns regarding them, concerns which confound Hyde's and Maquet's interpretations of the nature of "art" in at least four ways. First, these arts are marketed for personal gain. Second, they are devoid of any "mystical" feeling or spirit of gift exchange. Third, they are made by a people who do not share our concept of "art," and fourth, the producers themselves "consume" entirely different arts which usually originate in the very culture to which their commercial arts are sold.

We must therefore recognize that "art," whether as intangible expressive culture or in material form, is a socially constructed concept of our own society. Thus, the analysis of what we choose to collect — or even call art — reveals at least as much about ourselves as it does about the people who create it.

Contemporary research in the recently resuscitated field of material culture is beginning to focus as much on collecting and what we say about collections, as on the objects themselves. Dominguez (1986) outlines some of the tentative findings: that in collecting we search for "authenticity," especially among the small-scale societies which are in danger of disappearing under the onslaught of our own culture, with the assumption that the objects are both metanyms for the people who made them, and at the same time, are most meaningful to us in our own frantic efforts to construct a holistic world view.

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The Law and Its Institutions in the North

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Introduction

The title of this conference, "Knowing the North: Integrating Tradition, Science and Technology," though very general, lacks reference to an important dimension of our societal organization: the law and its institutions. Yet law interacts with and influences tradition, science, and technology in many ways, especially in the North.[1]

The English common law was introduced when those areas that now comprise the northern territories became part of the Dominion of Canada in 1870. Little was known about these areas and little thought was given to the suitability of such a legal system for the people who lived there. By the 1950s the impact of the common law began to be felt in northern Canada and northern judges had to consider whether, and if so, how, these laws could be melded with traditions that had evolved to fit the unique geographical and cultural environment of the North. As illustrated in the first section of the paper, this is a continuing challenge for northern judges and has resulted in some unusual jurisprudence.

The unremitting march of technology into northern Canada has wrought social and economic change which in turn has elicited adjustments in the legal and political system. Northern awareness about the impact of southern technology was sharpened as a result of the mid-1970s proposals to build gas pipelines from the Arctic. One side effect of this increased awareness has been experimentation with northern political and administrative systems.

And what of science? The legal system has had great difficulty in coping with lack of scientific knowledge and with scientific uncertainty. Scientific knowledge has affected the means by which northern resources have been managed and has influenced the development of decision-making mechanisms that differ from those found in other parts of the country. The structure and fabric of these mechanisms reflect a growing recognition that experience-based knowledge can enhance scientific knowledge.

This paper outlines some of the contributions which Canada's North has made to the country's laws and legal institutions. It begins with an examination of the way in which northern courts have dealt with issues that either do not arise elsewhere or that present an unusual dimension in a northern context. Secondly, the legal, constitutional and policy underpinnings of aboriginal land claims are canvassed. The third part of the paper considers administrative and political change in Yukon and the Northwest Territories. The final portion reflects upon how northern life and experience have enriched Canadian law and institutions and examines the need for further knowledge and research.

II. The Unique Contribution of the Northern Courts

Courts in the two territories face unusual legal problems and are developing unique jurisprudence. The following section, which provides a taste of northern legal issues, omits reference to aboriginal rights cases, as these are dealt with in the next part of the paper. The five types of cases overviewed deal with criminal

[1] A more detailed version of this paper is found in (1986) 4 C.N.L.R.I.

law, hunting rights, residency requirements, environmental matters, and customary family law.

A. Criminal Law: Sentencing and Procedure

Criminal law cases dominate the northern law reports, posing issues that illustrate the evolution of northern life. Two recent cases have considered the appropriateness of sentences which restrict the use of firearms by aboriginal hunters and trappers. In *R. v. Tobac,* (N.W.T.R. 201 1985, 1 C.N.L.R. 138 1986 N.W.T.C.A.) the accused was convicted of assault with intent to wound and had been prohibited by the trial judge from being in possession of a firearm for five years. The accused, who engaged in hunting and trapping along with wage employment, appealed this part of the sentence as being cruel and unusual punishment contrary to the Canadian Charter of Rights and Freedoms. The general legal principles applied by the Northwest Territories Court of Appeal required that the punishment be found to be monstrously unfit in order to be classified as "cruel and unusual." The accused trapped part-time, often as part of a group where others had firearms, and thus his inability to carry a gun would not prevent him from continuing to trap. The court recognized that there might be instances where a trapper would be adversely affected by a sentence such as this, but was swayed by the fact that it was not satisfactorily established that there are any Canadians deprived of subsistence for lack of a firearm.

A sentence issue also arose in *Shimout v. R.* (2 C.N.L.R. 168 1986 N.W.T.S.C.) where the accused breached hunting laws by slaughtering walrus only for their tusks and then wasting the meat. Of particular interest is that the Crown evidence included testimony by the Chairman of the local Hunters' and Trappers' Association concerning proper hunting practices and customs. Because the Criminal Code permits payment of fines only to the Crown, the appeal court overturned the portion of the trial court sentence that required payment of a fine to the local Hunters' and Trappers' Association. Instead, the accused was ordered to perform one hundred hours of community service to the Association, including an education program for young people concerning conservation practices. This is an illustration of how the judicial system can rely upon and support local institutions and practices.

Inuit customs have been discussed in other sentencing cases. In *Saila v. R.* (1984 N.W.T.R. 176 N.W.T.S.C.), the accused was convicted of theft in Spence Bay, which was not his usual home. He had a long previous criminal record and, as part of his sentence, the local Justice of the Peace ordered him not to return to Spence Bay. The appeal court upheld this part of the probation order, but restricted its application to a period of one year. Observing that the justices of the peace were long-term residents of generally crime-free communities, the Supreme Court of the NWT placed reliance upon the traditional means of community discipline such as ostracism and banishment.

Traditional methods of dealing with offenders proved more controversial in *R. v. J.N.* (1986 N.W.T.R. 128 N.W.T.C.A.). A twenty-one year old Inuk, resident in a small Inuit community, pleaded guilty to sexually assaulting his fourteen year old cousin with whom he had had previous consensual sexual relations. Some half of the four hundred local inhabitants attended the trial, where the evidence included testimony as to the role of the Inumarit Committee. Traditionally, such a group consisted of elders who rehabilitated community deviants through a process of confrontational counselling. In the past, if this approach failed, the accused might be banished from the community.

In the *J.N.* case, the Inumarit Committee had been in operation in this community since 1975. The trial judge, Bourassa J., sentenced the accused to 90 days' imprisonment to be served intermittently, followed by two years' probation. He found that the existence of the Inumarit Committee was a suitable alternative to the longer prison sentence that would normally be imposed. The majority of NWT Court of Appeal upheld the Crown's appeal of this sentence and substituted a prison term of 18 months which J.N. would have to serve outside the community. One factor that influenced the appeal Court was that

northern people have been exposed for some time to the same laws and customs as other Canadians. The court was also influenced by the fact that the present Inumarit Committee was not a direct successor to the traditional body described by the witnesses but carried out counselling in much the same fashion as would be done in any other Canadian community. Particular emphasis was placed upon the fact that one of the counsellors had been trained in the Canadian armed forces.

In two other recent cases (*R. v. J.S.B.*, [1985] 3 C.N.L.R. 121; *R. v. Baillargeon*, [1986] N.W.T.R. 121) the NWT Supreme Court has had to determine whether reliance upon local attitudes and customs is appropriate in cases involving wife beating and sexual assault. Referring to the finding of a task force on spousal assault in the N.W.T. that in many settlements spousal assault is not viewed as a community problem and that, behind closed doors, it can be condoned and even encouraged, one judge has observed:

> The courts of course do not accept the purport of that statement, and our law does not condone it ....
>
> This belief that marriage is some sort of servitude is not confined to Native society, it is a problem throughout Canada. Native people, like all Canadians, are subject to our criminal law. Spousal assault is no less serious because it occurs in a Dene village rather than a depressed or even affluent section of Toronto or Halifax....
>
> In my view, to take account of culture, isolation and other attitudes which are not in accord with clear Canadian law is just to delay the day of atonement. It only puts off the inevitable. [Marshall J. in *R. v. Baillargeon, id.* at 126]

Local northern considerations have also emerged in relation to procedural matters. For example, in *R. v. Anablak* ([1983] 4 C.N.L.R. 70), Mr. Justice Tallis of the NWT Supreme Court ordered a change in the venue of a murder trial from Coppermine (the location of the alleged murder) to Cambridge Bay. Although he relied upon general precedent in making his order, this is a problem more likely to arise in an isolated northern community than in other parts of the country, since the potential group of jurors is very small and social and family ties to the accused are likely to be more widespread within the community.

It is primarily because of small communities, limited numbers of possible jurors fluent in English, and the close-knit nature of isolated communities that the Canadian Criminal Code, which mandates twelve-member juries for other parts of the country, requires only six-member juries in the two northern territories. This special treatment of northern accused has been found to be unconstitutional on the ground that it contravenes the Charter's guarantee of equal protection of the law without discrimination (*R. v. Punch*, [1986] 1 W.W.R. 592, 2 C.N.L.R. 114 N.W.T.S.C.).

B. Hunting Bases

In the 1960s and early 1970s, a series of lawsuits challenged the applicability of hunting restrictions to aboriginals. Despite some success in the lower courts, in most of these decisions the restrictions were found valid.

In some recent cases, Caucasians have challenged the preferential hunting and fishing rights of aboriginals or sought to expand the group entitled to benefit from such rights. For example, in *Beattie v. Bergasse* ([1975] 6 W.W.R. 577 N.W.T.S.C.), the Caucasian applicant sought a general hunting licence on the ground that he was "a member of a family or group that prior to 30th June 1953 hunted lawfully in the Territories." He relied upon his marriage to a woman whose mother and grandmother were treaty Indians, and the fact that both she and her father had held general hunting licences. Three Native organizations (the Indian Brotherhood, the Committee for Original Peoples' Entitlement and the Inuit Tapirisat of Canada) were permitted to intervene in the case.

The application was denied because Mr. Justice Morrow could not find evidence that Mrs. Beattie's father in association with his Slavey wife had hunted as a "family or group" prior to the relevant date. Had there been such evidence, he would have found the applicant a member of

that group by virtue of his marriage.

In *R. v. Rocher* ([1982] 3 C.N.L.R. 122 (N.W.T.Terr. Ct.), reversed by [1983] N.W.T.R. 123, 3 C.N.L.R. 136 (N.W.T.S.C.), reversed by [1984] N.W.T.R. 288, [1985] 2 C.N.L.R. 151 (N.W.T.C.A.), a non-Native fisherman was accused of breaching the Fisheries Act by fishing for food for his dogs without a licence. The NWT Fishery Regulations exempted Native fishermen from licence requirements in such a situation and Mr. Rocher argued that this exemption offended the Bill of Rights because it discriminated against non-Native people like himself who live off the land. The Dene Nation and the Metis Association of the Northwest Territories intervened in this case before the NWT Court of Appeal, where the special rights were upheld because the provision was based upon a valid objective: the setting of a conservation scheme for fish with priority accorded to Native users.

In another recent hunting case, it was argued that a provision of the Wildlife Ordinance conflicted with the Bill of Rights by depriving an individual of property acquired by customary law. In *R. v. Curley* ([1982] 2 C.N.L.R. 171), the accused was charged under the Wildlife Ordinance with failing to notify a wildlife officer when a polar bear had been killed in defence of life or property. The Ordinance stated that the skin of a bear killed in such circumstances became the property of the Crown. Mr. Curley refused to return the skin to the Crown, arguing that according to Inuit custom the bear belonged to him because he had drawn the first blood, even though his companion's shot actually killed the bear. His Bill of Rights argument was rejected by the Court on the theory that he had never acquired property rights in a defence-killed bear.

Although we are likely to see future attacks upon the special hunting rights of Native people based upon the Charter of Rights and Freedoms, s.25 of the Charter provides some protection from this. It states:

> s.25 The guarantee in this Charter of certain rights and freedoms shall not be construed so as to abrogate or derogate from any aboriginal, treaty or other rights or freedoms that pertain to the aboriginal peoples of Canada including
>
> (a) any rights or freedoms that have been recognized by the Royal Proclamation of October 7, 1963; and
>
> (b) any rights or freedoms that now exist by way of land claims agreements or may be so acquired.

C Residency Requirements

The enactment of the Charter of Rights and Freedoms has given rise to another interesting issue, namely, the extent to which voting residency requirements may be invalid. This question is of particular interest to Native organizations since some land claims proposals advocate voting rights in the Territories only for those who meet relatively lengthy residency tests. Despite some early results in the courts to the contrary, residency requirements generally have been upheld.

The Northwest Territories Court of Appeal considered this matter in *Allman v. Commission of Northwest Territories* ([1984] N.W.T.R. 65 N.W.T.C.A.) in the context of the Plebiscite Ordinance, which required three years' residency in order to vote. The plebiscite in which the plaintiffs were denied the right to vote concerned the possible division of the NWT. The Court of Appeal could not find the residency requirement in breach of the plaintiffs' right to freedom of expression guaranteed by s.2 of the Charter nor of their mobility rights protected by s.2.6 of the Charter.

A similar matter came before the Yukon Supreme Court in *Hedstrom v. Commission of Yukon Territory and Council for Yukon Indians* ([1985] 6 W.W.R. 690 Yukon S.C.); the court struck down s.18(1)(c) of the Elections Act which required a twelve-month residency in the Territory in order to vote in a territorial election. Maddison, J. followed the *Allman* decision in relation to the Charter's mobility provisions, but held that s.18(1)(c) of the Act contravened s.3 of the Charter which entitles citizens to vote in elections of members of a legislative assembly. The Court was unable to find any grounds upon which this requirement could be classed as a

"reasonable limit" pursuant to s.1 of the Charter.

On the heels of this decision, the impugned section was amended temporarily to provide for a six-month residency qualification. In the meantime, the following question was put to the Yukon Court of Appeal by the Executive Council of the Yukon Territory:

> Whether it is within the legislative competence of the Legislative Assembly of the Yukon Territory to define a residency requirement in respect of voting in a Yukon territorial election of: (a) one year; (b) six months; (c) a minimum time necessary for administrative purposes. [Reference Re Yukon Election Residency Requirements, [1986] 4 W.W.R. 79 (Yukon C.A.)]

The appeal from the *Hedstrom* decision was subsumed in the reference, by agreement. The Territorial government, the Council for Yukon Indians, and the Dene Nation all argued in favor of the residency restriction, while court-appointed counsel argued the negative case.

The Court of Appeal upheld the Assembly's competence to define a residency requirement in respect of voting and advised that, in Yukon, the period should be twelve months. Agreeing that a reasonable residency qualification may be implicit in s.3 of the Charter, Chief Justice Nemetz held that a short qualifying period is a reasonable requirement demonstrably justified in a free and democratic society. Some of the purposes to be accomplished through a residency period are:

- assurance of the integrity of the electoral process;
- assurance that the voters are properly informed of the issues in any election; and
- assurance that voters have a sufficient connection with the Territory.

He noted that a majority of Canadian provinces have a residency requirement of six months, but felt that Yukon's should be comparable to that in the NWT, namely twelve months.

Arrangements for even longer residency requirements that may be accepted as part of future land claims agreements will be capable of protection from attack by virtue of s.25 of the Charter, quoted in the previous section.

D. The Environment

Given the sensitivity of the northern environment, the important role played by the northern courts in environmental litigation over the last fifteen years should not surprise us. Although the principles they have applied do not deviate from those employed in other parts of the country, the leadership of the northern courts is especially evident in regard to the sentencing of corporations found in breach of environmental requirements.

An example of how seriously northern courts treat severe cases of pollution is found in *R. v. Panarctic Oils Limited*.[2] Panarctic was convicted on several counts of breaching the Ocean Dumping Control Act, when, over the course of nearly two weeks, its employees (with the involvement of several supervisors) continually dumped refuse through a hole in the ice, including oil drums, wooden pallets, cement, scrap metal, and a pick-up truck.

The willful nature of the offences, the fact that they were taken in order to give the company advantage and the accused's record of previous convictions of this kind convinced the court that the corporate attitude involved "a willful flouting and ignoring of the laws and the permit requirements.... The Corporation's verbal assurances with respect to the environment do not appear to have worked in the past..." ([1983] 204 A.R. 199 N.W.T. Terr. Ct.). Thus, in the court's view these offences fell into the worst case category. The court imposed fines of $85,000 and $65,000 for the two counts (where the maximum fines were $100,000 and $75,000 respectively), and placed the company on probation for two years, requiring it to file with the court "a detailed written policy for the correcting of the situation that led up to these offenses and which includes a system for its enforcement and an undertaking that the policy will be implemented" ([1983] 215 A.R. 199 N.W.T. Terr. Ct.).

E. Customary Law

Judicial recognition of customary laws, par-

[2] (1983) 43 A.R. 199 (N.W.T. Terr. Ct.) A companion decision reported in (1983) 44 A.R. 385 deals with the accused's defence of due diligence, which was rejected.

ticularly in regard to marriage and adoption, focused attention upon the early decisions of the northern courts. In addition to the comprehensive discussion of these cases found in the writings of Justices Sissons and Morrow, a recent article has summarized cases in this area up to 1984 (Zlotkin 1984). The author, Professor Zlotkin, points out that in recent cases customary adoption has been recognized even where one of the adoptive parents is non-Native. Moreover, in some recent cases there has been an absence of the isolation of the parties and inability to comply with established regulations which provided much of the rationale for recognition of customary practice in the early cases.

There is some (admittedly limited) recent authority to suggest that the courts may be moving away from the notion of customary adoption. *C.K. and E.K. v. C.E.* ([1986] 2 C.N.L.R. 38 N.W.T.S.C.) was a factually complex case involving an application for custody of a child by his parents by customary adoption. In denying the application of the adoptive parents and awarding custody to the child's father, the court relied upon its inherent equitable jurisdiction over custody matters and declined to consider the effect of the adoption by Native custom. Marshall, J. added at 42:

> ... the law in regard to Native custom adoption ... juxtaposed as it is with current social development in the North, leaves the rationale in that process somewhat cryptic and dubious.

Whether this view marks a new trend in judicial thinking will not become clear until further development in the case law. However, it illustrates the danger that if judges fail to give a cogent explanation for their reliance upon customary law, later courts may be disinclined to take customary law into account. It should also be noted that it is possible to successfully assert customary law in the courts only if there is convincing evidence of its existence and operation in the communities.

III. Aboriginal Land Claims

No northern issue has attracted greater attention or caused greater perplexity over the past two decades than aboriginal land claims. It has embroiled the courts, legislators, commissions of inquiry, and decision-makers in resources companies. It has provided an organizational theme for Native groups as well as part of the rationale for division of the Northwest Territories. Thus, it is an issue that scarcely can be ignored in a discussion of northern law and legal institutions.

The following section provides an overview of the developments of the past two decades concerning this matter, considering in turn the role of the courts, constitutional implications of aboriginal rights, and the intertwining of the land claims issue with northern resource development policy.

A. The Role of the Courts

The foundations of aboriginal land rights in the Canadian legal system received clear recognition by the Supreme Court of Canada in *Calder et al. v. Attorney General of British Columbia* ([1973] S.C.R. 313, affg. (1971) 13 D.L.R. (3d) 64 (B.C.C.A.), affg. (1969) 8 D.L.R. (3d) 59 (B.C.S.C.)). A trilogy of subsequent cases originating in northern Canada have also been significant. In *Re Paulette et al. and Registrar of Titles* ([1977] 2 S.C.R. 628, affg. (1976) 63 D.L.R. (3d), 1 (N.W.T.C.A.), revg. 42 D.L.R. (3d) 8, (1973) 6 W.W.R. 97 (N.W.T.S.C.)) sixteen Indian chiefs from the Northwest Territories sought to file a caveat (or caution) against some 400,000 square miles of land, based upon unextinguished aboriginal rights. This action eventually was dismissed by the Supreme Court of Canada on a technical ground but has been of lasting importance because of the trial judge's doubt whether Treaties 8 and 11 had legally terminated land rights.

An injunction application by the Cree and Inuit of James Bay and northern Quebec to halt the massive James Bay hydroelectric development in 1974 was a major factor in the successful conclusion of the James Bay and Northern Quebec Agreement, the first modern Canadian land claims agreement ([1974] R.P. 38 (Que. S.C.), reversed by the Quebec Court of Appeal in [1975] C.A. 166). A few years later, the Inuit of Baker Lake in the Keewatin district of the

Northwest Territories sought a declaration that their aboriginal rights were unextinguished and an injunction prohibiting certain mining activities that, in their view, interfered with their traditional caribou hunting.[3] Mr. Justice Mahoney upheld the plaintiffs' aboriginal rights but refused to grant the injunction because the evidence did not satisfy him that the mining activities had caused a decline in the local caribou herds.

B. *Constitutional Implications of Aboriginal Rights*

Both the northern and southern courts undoubtedly will continue to play an important role in relation to aboriginal rights in Canada. Yet the judicial contribution has been mixed. Lawsuits are time-consuming and expensive and lead to uncertain and unpredictable outcomes. Moreover, judicial decisions tend to favour one part totally to the detriment of the other(s); court cases are characterized by all-or-nothing results with no possibility of complex rulings, the implementation of which would require judicial supervision. And while Canadian courts have contributed to the legal definition of aboriginal rights, the judicial process has been tortuous with many of the key aboriginal arguments lost on technical or procedural grounds.

As discussed in the next section, for over a decade the Government of Canada has pursued a policy of negotiating comprehensive claims. The apparent failure of that policy and the fear of legislative and administrative extinguishment of aboriginal rights led to a major lobbying effort to ensure constitutional protection of such rights. Amendments to the Canadian Constitution in 1982 and 1983 resulted in the following provisions in Appendix II of the Constitution Act 1982:

> 35. (1) The existing aboriginal and treaty rights of the aboriginal peoples of Canada are hereby recognized and affirmed.
>
> (2) In this Act, "aboriginal peoples of Canada" includes the Indian, Inuit and Metis peoples of Canada.
>
> (3) For greater certainty, in subsection (1) "treaty rights" includes rights that now exist by way of land claims agreements or may be so acquired
> ....

It will take several decades and much judicial ink before the impact of s.35 on Canadian law and policy is fully apparent. Most commentators on s.35 have agreed that it has at least one major effect: aboriginal rights can no longer be extinguished by legislative or administrative action alone. Rather, they can be affected only by constitutional amendment or with the consent of the aboriginal rights owners. If this view is correct, aboriginal rights have been elevated to a new, more secure position in Canadian law.

C *Land Claims and Northern Resource Development Policy*

When exploration for non-renewable resources in the territories gained momentum in the 1960s, little attention was paid to possible aboriginal land claims. Thus, for example, the federal legislation authorizing petroleum exploration made no reference to aboriginal rights and explorers moved rigs into remote areas without notifying local communities. Protests from Native people, who at that time lacked political organizations, seemed to fall upon deaf ears.

The *Calder* decision forced the federal government to reassess its denial of the existence of aboriginal rights. In August 1973, the then Minister of Indian Affairs and Northern Development, the Hon. Jean Chretien, announced that the federal government would undertake negotiations with representatives of Native peoples claiming aboriginal rights in areas where there had been no treaties and where such rights had not been superseded by law. These so-called

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[3] *Hamlet of Baker Lake et al. v. Minister of Indian Affairs and Northern Development* (1980), 107 D.L.R. (3d) 513, 5 W.W.R. 193 (F.C.T.D.). This decision has been examined in Vol. VIII, #3, 1980 Northern Perspectives. See also J.E. Bickenback, The Baker Lake cases: a partial recognition of aboriginal title, (1980) 38 U.T. Fac. L. Rev. 232.

"comprehensive claims" were stated to exist in British Columbia, northern Quebec, and the two northern territories. The basis of negotiations would be that where traditional interests in the lands concerned could be established, an agreed form of compensation or benefit would be provided to Native peoples in return for their interest. Over the next few years the details of the policy crystallized and eventually the policy appeared in a booklet called *In All Fairness*. In the meantime, the Office of Native Claims was established within the department to administer the policy, funds were provided to several Native organizations to prepare for and conduct negotiations, and negotiations were launched with a number of groups.

Thirteen years and more than $100 million later,[4] arrangements had been finalized only in regard to one relatively small claim, that of the Inuvialuit of the Western Arctic.[5] Wide-spread dissatisfaction with the comprehensive claims policy on the part of government, industry and aboriginal groups led to the establishment of a federal task force in July 1985 to review the policy and make recommendations concerning the future. The Report of the Task Force to Review Comprehensive Claims Policy was submitted to the Minister in December 1985 and released to the public in March of 1986.

The report criticizes the existing policy for treating the settlement of aboriginal land claims as a one-shot real estate deal in which rights are to be exchanged for cash and land. Some of the failure of the current policy is ascribed to its requirement that all aboriginal rights be extinguished, an approach that has been rejected almost unanimously by Native leaders. Instead, it is suggested that land claims should be viewed as a process for defining the long-term relationship between aboriginal and non-aboriginal societies. This would mean that not all aspects of land claims agreements necessarily would be final. For example, although land ownership and cash compensation should be finalized in a land claims agreement, other matters (such as political, linguistic, and educational matters) might be reviewed at regular intervals to ensure that the agreement is achieving its goals.

The report suggests that the requirement of extinguishing all aboriginal rights conflicts with the constitutional protection of these rights. A review of the history of government practice reveals that this was not always the policy. For example, in some pre-Confederation treaties, aboriginal rights were extinguished only in regard to parts of the claimed area. Nevertheless, these treaties provided sufficient certainty to facilitate the development of lands and resources in the claimed area. A similar approach might be acceptable to some negotiating groups today. Another alternative would be to set aside the issue of aboriginal rights, reminiscent of the way in which the issue of offshore jurisdiction was finessed in the 1982 federal-Nova Scotia agreement on management of offshore petroleum resources. Above all, the report stresses that if the new policy is to have greater success than the old, there must be a flexible and innovative approach to the extinguishment issue.

The task force also considered how the status quo can be protected while claims are being negotiated. It rejected the position urged by many aboriginal groups that resource development activities should be frozen while a claim is pending. The task force reasoned that this could harm inhabitants of Native communities who earn wages in the resource industries. On the other hand, the report rejects the idea that development should proceed without constraint

[4] Living Treaties: Lasting Agreements Report of the Task Force to Review Comprehensive Claims Policy (Minister of Indian Affairs and Northern Development, Ottawa, 1985). The report is sometimes referred to by the name of the Task Force Chairman, Mr. Murray Coolican. The information on costs is contained in Mr. Coolican's letter to the Minister.

[5] The Western Arctic Claim: The Inuvialuit Final Agreement (Minister of Indian Affairs and Northern Development: Ottawa, 1984), hereinafter referred to as the "COPE Agreement." Final agreement was only reached after compromise was agreed upon in the matter of overlapping Native land claims in the area involved, with other such overlap areas remaining elsewhere in the N.W.T. — W.C. Wonders, Overlapping Land Use and Occupancy of Dene, Metis, Inuvialuit and Inuit in the Northwest Territories (Dept. of Indian Affairs and Northern Development: Ottawa, 1984).

in claimed areas:

> ...[T]he current situation is unfair to aboriginal groups. Although the federal government has agreed to negotiate claims relating to vast areas, it continues to behave as though claims did not exist. Land is alienated, projects are authorized, and management decisions are made with little (if any) regard to the claim. For the government, business proceeds much as usual. Because the functions of government are unimpaired by the claim, government feels no pressure to move negotiations forward.
>
> Aboriginals, meanwhile, see their claim area being subjected to more and more third party interests. Their options disappear before their eyes. Their only method of encouraging the federal government to take their claim seriously is through litigation. [63]

The task force recommended that, while negotiations are proceeding, aboriginal groups north of 60° should be entitled to participate in decisions concerning activities or alienations in relation to the claimed area that could derogate from their claims. The means of participation should be one of the first matters to be negotiated in the claims process. The method of participation should be simple and expeditious, should ensure the protection of the aboriginal interest, and should not replace other mechanisms such as comprehensive land use planning arrangements. In the interim, consideration should be given to the establishment of a Heritage Trust Fund into which could be channelled revenues from developments that proceed prior to the resolution of the claim, to be shared later when details have been worked out.

Many of the task force recommendations have been reflected in a new government policy statement,[6] but no new claims agreements have been announced.

[6] See statement made to the House of Commons on December 18, 1986, by the Hon. Bill McKnight, Minister of Indian and Northern Affairs.

IV. Administrative and Political Change in the North

A. Mechanisms for Northern Resource Decision-Making

During northern resource exploration initiatives of the 1960s and 1970s, aboriginal communities commonly complained that they had no power to influence decisions concerning activities on lands they claimed. This criticism applied to a myriad of activities, including game regulations, the establishment of national parks, the issuance of land use permits, and the construction of mines, pipelines and other major facilities.

While this remains an important issue, northern Natives now participate in a number of bodies involved in resource management. For example, the COPE Agreement provides for the setting up of six bodies which will play roles in resource management and to which the Inuvialuit are entitled to appoint representatives. The Tungavik Federation of Nunavut and the federal government have reinitialled a Wildlife Agreement in Principle which provides for a Nunavut Wildlife Management Board comprising four members appointed by each of the government and the Inuit, with an independent chairman (Northern Decisions, Vol. 4 #4, May 31 1986, p. 28). A Working Group on Land and Water Management has been established to develop proposals for managing land and water uses with a Dene/Metis settlement area; based upon an Interim Agreement on Key Elements of Land and Resources signed in July 1985 by the Dene/Metis and the federal government, one of its purposes is to propose a set of principles for developing appropriate institutions, in light of a review of the existing land and water management system (Northern Decisions, Vol. 3 #20, Feb. 28, 1986, p. 153).

Two bodies have also been set up to oversee the management of caribou populations. The Beverly-Kaminuriak Caribou Management Board was established in the early 1980s as a result of cooperation between the governments of Canada, Saskatchewan, and Manitoba, and five user groups (the Keewatin Wildlife Federation, the Dene Nation, the Metis Association of the NWT

and representatives from communities in northern Saskatchewan and Manitoba (Rueggeberg and Thompson 1984).

Another board is concerned with the Porcupine Caribou Herd (Northern Decisions, Vol. 4 #5, June 1986, p. 40). Other new institutions have emerged from the land use planning process which was agreed to in 1983 by Canada, the Government of the Northwest Territories, the Dene Nation, the Metis Association of the Northwest Territories, and the Tungavik Federation of Nunavut.[7]

Although many of the bodies described above have mere advisory powers, their existence shows a radical move toward local and user participation in resource management. And while such groups do not mean that all problems of participation have been resolved, there has been a major shift in government policy and practice over the past decade. These developments raise new questions and issues for the future which will be examined in the concluding part of the paper.

B. Possible Division of the Northwest Territories

The history of northern political evolution cannot be examined here, except to note that the councils/legislative assemblies of both territories are now fully elected, and that in the Northwest Territories the assembly is currently made up of a majority of Native members, several of whom serve on the powerful Executive Council.

The possibility of dividing the NWT into more manageable units was considered and rejected in 1966 by the Carrothers Commission. The issue re-emerged in the mid-1970s when the Inuit of the Eastern Arctic, as part of their land claims proposal, advocated the carving out of a new territory, Nunavut. Following approval in principle of the division concept by the Legislative Assembly in 1980, a territory-wide plebiscite was held in 1982 in which fifty-two percent of the voters indicated support for division. The creation of Nunavut was agreed to in principle later in the same year by the Minister of Indian Affairs and Northern Development, but subject to a number of conditions. One of the most important of these is that the people of the territories must agree to an appropriate boundary.

With funding from the federal government, a Constitutional Alliance was established in 1982 comprised of several members of the Legislative Assembly and leaders of the four major aboriginal groups. The Alliance is divided into two groups, the Western Constitutional Forum (WCF) which deals with issues in the proposed western region and the Nunavut Constitutional Forum (NCF) which deals with the east. Part of the Alliance's mandate is to select an appropriate boundary and submit it to the public for consideration and approval. This issue has proven troublesome and the future of the boundary is unclear.

Nevertheless, the two forums have stimulated public discussion of many other matters. Both groups have prepared and distributed discussion papers and documents in several languages and have held workshops and seminars throughout the North. In this atmosphere of grass-roots participatory democracy, consideration is being given to forms of government that could differ from those found in southern Canada. For example, one of the principles that has been put forward by the Government of the Northwest Territories regarding the political and constitutional process is that, in the design of public structures, consideration should be given to allow variations to reflect customary methods of decision-making. As the next section describes, to some extent the form of government already present in the NWT differs from its southern and Yukon counterparts.

Thus, one result of constitutional change in the NWT may be government structures that will set the territories apart from the rest of the country.

C The Nature of Government in the NWT

Although party politics have existed in

[7] The history of the land use planning process is outlined in Terry Fenge, Development in the Beaufort Sea Region: From EARP to regional planning. Northern Perspectives 6 Vol. 11 #3, May-June 1983 and Planning for Lancaster Sound: Where to now? Northern Perspectives 10 Vol. 14 #3, May-June 1986.

Yukon for some years, they have never taken root in the NWT. There, membership on the Executive Council of the Legislative Assembly is determined by an open election within the assembly. The efforts that are made to reach decisions through a consensual process may stem from the cultural tradition of the aboriginal members of the assembly. Perhaps as a result of this process, which, by southern standards, is unconventional, government in the Northwest Territories has been characterized by some unusual approaches.

An example is the way in which the Northwest Territories government has approached devolution of political responsibility. Although authority over many matters has been transferred gradually from the federal government, territorial inability to supervise most land and resource matters has remained an irritation to the northern governments. One strategy in the NWT has been to produce territorial *policies* that affect the way in which development is pursued. For example, a policy on renewable resource compensation requires developers whose activities might affect renewable resource harvesting activities to submit a Compensation Plan prior to any approval of their activities (Government of the Northwest Territories 1984). One principle underlying this policy is that those who rely upon renewable resources should be protected from the impact of development.

Given the junior status of the territorial government and Ottawa's overall stranglehold over non-renewable resources, it is doubtful that such a policy has legal validity. In other words, a developer could ignore it without fear of prosecution. On the other hand, there are related matters over which the territorial government does have authority and in regard to which developers must deal with it. There is also the likelihood that, with devolution, the role of the territorial government will increase, giving it more clout over developers who ignore its policies today. Regardless of legal niceties, then, pragmatic developers with an eye to tomorrow must comply with such policies notwithstanding their dubious validity. Thus, through its aggressive stance, the NWT government has managed to enhance its influence and increase local input even though its formal jurisdiction over non-renewable resources remains circumscribed.

V. Conclusions

Despite serious economic problems resulting from the collapse of the fur industry and downturns in the mining and petroleum sectors, it is clear from the above review that the North today is a vital, dynamic place where laws and legal institutions are undergoing exciting change. Moreover, northern laws and institutions form a unique pattern in the patchwork quilt that represents the legal system of the country as a whole.

Yet there are major differences between the two territories. The analysis of northern jurisprudence shows that it is mostly the NWT courts that, over the past three decades, have made decisions that are unique in a national context. A similar observation may be made about recent administrative and political change: unusual institutions for resource decision-making have flourished in the NWT and innovative approaches to both devolution and division have been taken by the Government of the Northwest Territories. To what can these differences between the two territories be ascribed? There is a wealth of opportunity for scholarly inquiry into this question. How has the political history of the two territories differed and what are the implications of this for future forms of government? In what ways has the fact of an aboriginal majority on the Legislative Assembly of the NWT influenced government policy and practice? Why have the two territories developed such different strategies for dealing with Ottawa? How do the laws and institutions of the two territories compare and what explanations are there for the differences? Why have lawyers in the NWT, and not in Yukon, framed cases relying upon customary law and practice? Why have judges in the NWT accepted such arguments? These and a myriad of other questions seem to have been almost completely ignored by northern scholars.

Northern courts have been the birth-place of most of the Canadian decisions on customary law, a process which began in the mid-twentieth

century and continues today. The sensitivity of some northern judges to their unique environment has helped to demonstrate the flexibility and adaptability of the common law system. Important questions remain about the appropriate limits to this flexibility. For example, evidence about customary techniques has been accepted to highlight wasteful hunting practices, yet customary rules concerning ownership of wildlife have been rejected. Local organizations such as Hunters' and Trappers' Associations have been supported by sentences in some cases, while the usefulness of an institution such as the Inumarit Committee has been questioned in others. One judge has suggested that the rationale for employing customary adoption practices may no longer exist. Yet in the *Saila* case, the customary practice of ostracism took on a modern cast through a probation order which temporarily banished the accused from the community. It seems, then, that the courts have yet to define clearly the circumstances under which they will support local traditions that have been adapted to fit the changing needs of northern communities. One prerequisite to reliance upon customary law arguments is strong evidence as to the existence and function of such practices. In Canada, there is a dearth of legal/anthropological research to meet this requirement. Such research should be encouraged and supported.

New life may be breathed into customary law arguments by the recent provisions in the Constitution that recognize the existence of aboriginal rights and the multicultural heritage of Canada. Furthermore, to the extent that these constitutional themes are argued before southern judges, the northern cases may provide helpful precedents.

The North has already become, and will continue to be, a significant testing-ground for the provisions of the Charter of Rights and Freedoms. The size of the aboriginal population and the special protections for aboriginal people found in northern laws are sure to give rise to cases about equality rights. The decisions that have already been made about the size of juries and residency requirements for voters illustrate the possible contexts.

The North may also offer some useful lessons concerning the enforcement of environmental laws. Northern courts have experimented with sentencing approaches, employing probation orders against corporations and making orders intended to improve compliance with environmental standards. How successful have these approaches been? This question is especially important today in light of the growing debate about the suitability of criminal law as a tool for environmental protection, compared with other legal devices such as contracts. The North may provide excellent opportunities for testing these divergent viewpoints.

Southern thinking about aboriginal rights and land claims has been greatly influenced by events in the North. Some credit for this belongs to the judges who have heard aboriginal rights cases. The northern Native organizations have also played a significant role by explaining their situation and thus helping to sensitize southerners to the issue as it exists in areas south of 60°. The modern land claims agreements all have originated in northern areas and may supply answers to questions that arise elsewhere in Canada. There is much to be learned about the *process* for achieving land claims agreements. What works and why? For example, could mediation techniques be usefully employed? How can the *implementation* of land claims agreements be improved? These are crucial matters that, due to time and budget limitations, the Task Force to Review Comprehensive Claims Policy was only able to touch upon. Yet we need to learn a great deal more about such issues if our future policies are to succeed.

There are many uncertainties concerning the societal and institutional restructuring that will be required by land claims agreements. A positive step toward addressing these difficulties is the cooperation between the Dene/Metis and the Government of the NWT in reviewing current land and water management systems and how they may need to be altered to facilitate a settlement. Complexities also underlie the relationship between political and constitutional change in the North and aboriginal aspirations for self-government.

The North has provided us with examples of methods for involving local people in resource decision-making. Now we need to find out what works and why, and how local input can be achieved without crippling the effectiveness and efficiency of the decision-making process. Are better decisions being made by bodies in which aboriginals have the right to participate, such as the land claims institutions, the caribou management boards and the land use planning committees? Is integration between scientific knowledge and experience-based knowledge being achieved? Are there some inherent conflicts that cannot be resolved simply by virtue of the right to participate in decisions? Are there enough qualified people willing to participate in such groups? How do the functions of the various committees and bodies interrelate and is the proliferation of institutions itself creating problems? The answers to these sorts of questions could also prove useful to southern Canadians.

The continuing process of devolution demonstrates the need for coordination between federal and territorial policies. Industry already feels that it is over-regulated in the North. It fears being caught in a power squeeze between federal and territorial policies not unlike that experienced by the petroleum industry in the western Canada-federal energy wars or the Newfoundland-federal offshore dispute. The faltering northern economy should provide even greater incentive for governments to avoid this kind of competition and thus it is important for us to understand how these federal-territorial arrangements can best be harmonized.

There remains a need for better communication among industry, governments, aboriginal groups, and the northern population as a whole. Some progress in this direction is apparent from the briefings which the Dene-Metis Secretariat has given the petroleum industry about its land claims proposals and the interest in aboriginal land claims which recently has been exhibited by the mining industry. Effective means of fostering such information exchanges need to be explored and, while this is an area in which government can take the lead, social scientists may be able to provide ideas about workable communication techniques.

It should be obvious that much of the research needs identified above would be met best by interdisciplinary efforts. But we should not jump upon the interdisciplinary bandwagon at the expense of basic research in required areas. For no one's interest will be served by work that lacks a solid foundation in discrete subject areas.

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Science and Politics in Polar Areas

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One hundred years ago, at the time of the First International Polar Year, political problems facing organizers of polar research were mainly related to personal and national prestige, competition for discoveries of new land and a race for the poles. Although international co-operation in polar science since that time has done away with many of the obstacles created by these jealousies, it is safe to say that national, social, economic, ethnic and military issues have increased in number and in seriousness. I shall not go into these developments *per se*, but look at them from the standpoint of a scientist or a promoter of polar research, and from my experience as director of the Norwegian Polar Research Institute during the same years as the Boreal Institute for Northern Studies has been in existence.

In the early years of polar science, decisions on research activity were made over the heads of the local ethnic groups in the Arctic. They no longer accept this procedure, and demand a stronger hand also in programming and executing research projects taking place in their own environment. I understand that this development which is encouraged in most Arctic rim countries has restricted the freedom of Arctic science in Greenland and North America. So far, this has been a concern mainly on the national scene. In the future it may turn out to be a factor of importance in international scientific co-operation also. However, since no indigenous peoples live in the areas of responsibility of the Norwegian Polar Research Institute, it has not been a problem to me.[1]

The complex political developments in the Arctic during this time created problems and obstacles, but also opportunities for polar science. To many the outlook for international co-operation in Arctic science looks rather bleak. For a time it looked unfavourable also in the Antarctic, but since the International Geophysical Year the developments took a new course, and it may be useful to start a study of the relationship of science and politics in polar areas with an analysis of the developments in Antarctica during and after the Second World War. I have often heard statements to the effect that the success of the international co-operation in Antarctica is due mainly to the absence of military and economic interests in the area. It is true that these interests are smaller, particularly those of the super powers, but they certainly have been present, and still are present, at the "bottom of the earth." The clash of territorial claims in Antarctica became acute during and after World War II, and they are still unsolved, in contrast to the situation in the Arctic. The recent Falkland Islands war was a reminder of the existing sovereignty problems in the South. I therefore agree with the statement of a noted Canadian polar science administrator, G.W. Rowley (1966): "The Antarctic was not a promising area for any sort of international co-operation." Up to the time of World War II, most expeditions were private, and only two countries, the UK and France, had made territorial claims, the former also on behalf of New Zealand and Australia.

World War II became a turning point in the history of Antarctica. Three new nations made

[1]The Norwegian Polar Research Institute is Norway's central institute for the scientific research of Svalbard, Jan Mayen, the Norwegian dependencies in the Antarctic and the polar seas, and for the mapping of the Norwegian polar land areas. — *Editor*

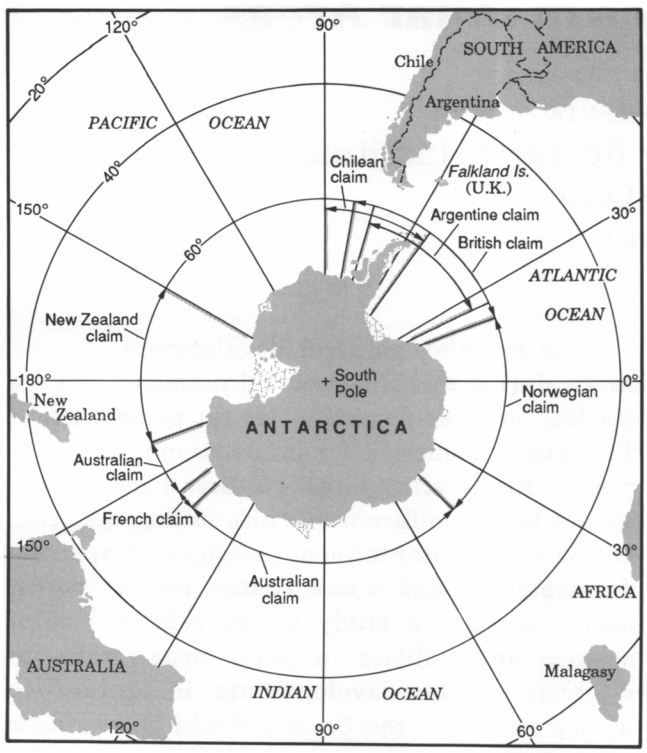

Figure 1. National Sectors in the Antarctic

territorial claims on the continent (Norway 1939, Chile 1940, Argentina 1942) (Figure 1). The USA considered making claims, but decided, like the USSR, not to recognize territorial claims of other nations, whilst reserving its right to make claims. The claims of the two South American states overlapped with the UK claim, as well as with each other, which gave rise to considerable diplomatic heat, and on one occasion gunfire. The reason was partly economic, partly strategic. The whaling industry had proved very profitable in Antarctic waters and the interest for other resources was awakening. During the war German submarines had used bases on sub-Antarctic islands for attacks on Allied ships and thus demonstrated the military interest of Antarctica. After the war it was suggested to use the remote continent for testing nuclear and other weapons.

The number of Antarctic expeditions grew, and very soon they became solely government-sponsored. In 1946-47 the USA sent the greatest expedition ever to be launched in Antarctica, "Operation Highjump" (4000 men and 13 ships, including icebreakers and an aircraft carrier). Scientific research was not the main objective on these expeditions. Under these circumstances Antarctic science could easily have taken a different and more chauvinistic course.

Fortunately, just at the right moment American physicists proposed holding a third international Polar Year in 1957-58, a year of maximum solar activity. The proposal was quickly approved by the International Council for Scientific Unions (ICSU). The World Meteorological Organization (WMO) joined it and suggested that a global approach would be more useful. It was agreed to arrange an International Geophysical Year (I.G.Y.), to last for 18 months. Twelve nations, including all the seven claimant states in Antarctica, and in addition Belgium, Japan, South Africa, the USA and the USSR, agreed to establish a total of 55 observatories in Antarctica. National committees were established, in most countries by the academies of science, to develop programs and coordinate the activities.

The great support given by the 12 nations to the I.G.Y. program in Antarctica also was no doubt based upon other interests than just the love of polar science. Nevertheless, the first Antarctic I.G.Y. conference decided that the program should be entirely scientific.

In 1957, ICSU took steps to examine the merits of further scientific investigations in Antarctica and in 1958 the Special Committee on Antarctic Research (SCAR) was established. In the same year it was also agreed to extend the I.G.Y. program in Antarctica for another year. The snowball had started rolling and soon SCAR was to be a permanent scientific committee under ICSU.

In 1959, the president of the USA, Dwight D. Eisenhower, called a conference of the same 12 nations to discuss an international political arrangement for Antarctica. It was agreed to establish a treaty for Antarctica to last for at least 30 years, which was put into effect in 1961. The main aspects are: to allow Antarctica to be used for peaceful purposes only (military activity, including testing of weapons is prohibited), freedom of scientific research and exchange of plans and results; freezing of territorial claims and abstaining from making new claims;

prohibition of nuclear explosions and dumping of radioactive waste; and the right to send observers to inspect all activities.

The Antarctic Treaty has no organization or secretariat, it operates only by consultative meetings. There is no formal link between the treaty system and SCAR, but from the very beginning of the treaty, the advice of SCAR was frequently sought by the parties to the consultative meetings. Very often Antarctic scientists were appointed members of, or advisors to the national delegations of the treaty meetings, since issues needing scientific advice were often on the agenda. The same scientists were frequently national delegates to the SCAR meetings, and although SCAR kept strictly to its scientific role, the scientific influence on the political processes of the treaty system has been strong. During the 1960s the treaty meetings adapted a number of measures for conservation of the Antarctic fauna and flora, and for protection of the Antarctic environment. Scientists did much of the preparatory work here, both in their national capacity and as members of advisory groups appointed by SCAR at the request of the consultative parties.

During the first 10 years of activity, often called the "honeymoon time" in Antarctica, the number of people attending the SCAR and treaty meetings was small. Because the scientists taking part in treaty work knew each other well and developed a mutual confidence, the amiable atmosphere at SCAR meetings was transferred to the political scene of the treaty, and an Antarctic solidarity was apparent on many occasions, facilitating otherwise controversial discussions. Then, in the beginning of the 1970s the resource problems in the Antarctic became urgent. During the negotiations of the treaty these problems were swept under the carpet, and the treaty had no reference to them. The early discussions were difficult, a change of atmosphere was apparent at the meetings, and the only substantial recommendations the parties could agree to were to request SCAR for advice on relevant scientific and environmental matters. But the strains were slowly overcome.

In 1972 the parties agreed to a seal convention, which regulated sealing in the Antarctic. Another renewable resource in Antarctic waters, the krill (a small crayfish), soon came into focus. This is considered one of the greatest protein resources in the world and was nearly untapped until Soviet and Japanese fishing vessels started to harvest krill in the late 1960s. The SCAR working group on biology drew attention to the key role played by krill in the Antarctic marine ecosystem and asked for increased marine biological research in the Southern Ocean. In 1975, SCAR and SCOR, in co-operation with a scientific committee of FAO, initiated the planning of this research. In the same year the question of a legal framework for protection and rational use of Antarctic marine living resources was raised by the host nations at the consultative treaty meeting in Oslo. SCAR was urged to continue its study of the matter which led to one of the largest co-operative marine research programs ever executed, the Biomass (Biological Investigations of Marine Antarctic Systems and Stocks) program whereby a dozen nations pooled research vessels and other resources for a 10 year period. After intense negotiations, the parties to the treaty, scientifically advised by SCAR, in 1980 were able to agree upon a Convention for Conservation of Antarctic living resources, which was put into operation in 1982. I would like to emphasize the unique character of this convention as a system based upon modern conservation and ecological principles, which is the result of the basic scientific work of SCAR and of the interaction with the Antarctic Treaty System.

However, the resource exploitation cloud hanging over the Antarctic has not yet lifted. The most sensitive and controversial resource problem is how to regulate eventual exploration and exploitation of possible mineral resources. This question is still being negotiated having been raised more than 15 years ago. The matter goes to the heart of the sovereignty problem which was shelved at the negotiation of the treaty in 1959, and it took several years before formal discussions between the parties took place. At the request of the parties to the treaty in 1975 SCAR has made preliminary assessments of the possible impact on the Antarctic environment if mineral exploration and/or exploitation were to

occur there, and has advised on the needs of related scientific programs. Meanwhile, the parties have continued their discussions on eventual mineral resource development, for a long time at a low speed. During the last few years, partly pushed by discussions in the United Nations, the deliberations have made good progress, and the outline of a regime is in sight.

The interaction of SCAR and the Antarctic Treaty System has also worked very well within a number of other aspects of man's impact on the Antarctic environment such as establishing codes of conduct for expeditions and scientific bases, tourist activity, aiding co-operation in transport and telecommunications, exchange of information etc. This successful interaction has been of mutual importance. SCAR has helped the treaty system to develop smoothly in many ways, even to broadening the original purpose of the treaty. On the other hand the recommendations of the consultative meetings have increased the status of Antarctic science in the eyes of governments and helped to secure the national funding of the scientific activity.

Still, there are some ambitious developments in the Antarctic: the extensive use of military personnel to support the Chilean and Argentine stations while at the same time performing military drill, and the redistribution of Soviet scientific stations, originally concentrated in the Australian sector of East Antarctica, now spread all around the Antarctic coastline.

Until recently, membership in SCAR has been reserved for nations having an active and continuing program of scientific research in the Antarctic. This has led to criticism of SCAR being an exclusive scientific club, closed to the outside world. I do not agree with this characterization, but the high expense of carrying out Antarctic research on a continuing basis has prevented many countries, otherwise capable of high quality Antarctic research, from joining the organization. At the XVIII SCAR meeting in Bremerhaven in 1984, I was asked, in consultation with other past presidents of SCAR, to submit a proposal to the SCAR executive for necessary changes of the constitution to accommodate a new category of members called associate members. The proposal was accepted at the SCAR meeting this year, and SCAR is now open to all nations having interests in Antarctic studies. They need have no intention of establishing an independent research program or making commitments as to the size or time span of future research.

I shall now return to the situation in the Arctic. Outstanding sovereignty claims for all land territory there were settled by unilateral action, negotiations, or court decisions during the last decades before World War II. Canada and the USSR announced then ownership of all lands and islands to the north of their Arctic mainlands, Denmark gained sovereignty over the whole of Greenland by a decision of the International Court at the Hague, and Norway in 1920 was given sovereignty over Svalbard according to a treaty designed by the peace conference in Paris (Figure 2). The effect of this "nationalization" of Arctic land territory for science was severe, since it limited the freedom of Arctic science by governmental regulation in all areas except Svalbard. Here Norway continued the "free science" policy, although this was not specifically granted by the Spitsbergen Treaty. True, the western Arctic rim nations all have exercised their jurisdiction liberally in granting their consent for properly equipped and designed scientific projects.

In the large part of the Arctic territory under Soviet rule, however, regulations have led to a complete elimination of scientific activity by foreign scientists. This, unfortunately, has even been extended to the Arctic waters north of the Soviet mainland, first by the extension of the territorial sea from 4 to 12 miles, thereby closing the straits which give access to the various eastern Arctic seas. Then, years before the Convention on the law of the sea was agreed to, the Soviet government made it mandatory for foreign scientists to apply for permission to perform any kind of marine scientific research inside a 200 nautical mile zone. This restrictive science policy was amply demonstrated when the Swedish Academy of Science and Letters planned a scientific icebreaker expedition (YMER 80) to follow the route of the *Vega* as a centennial celebration of E.A. Nordenskiöld's first navigation of the North-East Passage. The

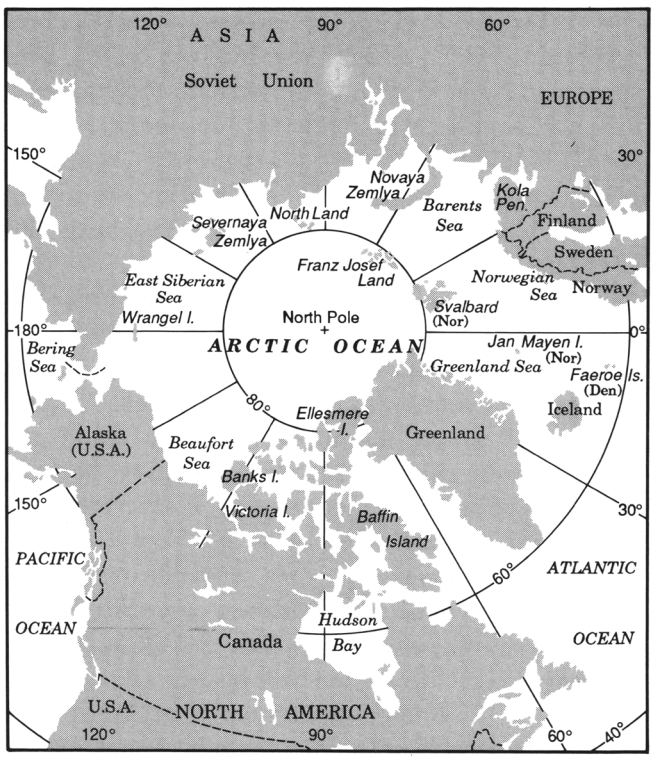

Figure 2. National Sectors in the Arctic

Swedish Academy asked for Soviet consent, at the same time inviting the Academy NAUK to participate, but never received an answer. After waiting nearly one and a half years the Swedish Academy gave up, and instead sent the expedition to the waters north of Svalbard, demonstrating the Swedish preference for international co-operation in polar science by carrying 43 foreign scientists (of a total number of 119) from eight nations on board.

We also have learned that the Soviet government does not like international or multinational scientific co-operation in the Arctic and, with one exception, does not allow its Arctic institutes to take part. The exception to this rule is the co-operation under the Polar Bear Agreement of 1973 between the USSR, USA, Canada, Denmark and Norway. It is often said that this co-operation is successful. To a certain extent this is true as meetings have been held and information has been exchanged. However, whereas the research data from the West has been comprehensive and up-to-date, the Soviet information has been rather meagre. Whether only little research has been carried out in the Soviet Union, or whether the data exchange is being hampered by governmental red tape it is difficult to tell. Soviet scientists have not been taking part in joint field studies under the agreement, nor have foreign scientists been invited to take part in field studies in the USSR. For the development of Soviet-Russian and Norwegian co-operation in the studies of the common polar bear population of the north-east part of the Barents Sea, the agreement has had no positive effect. During prolonged and abortive discussions in 1972-76 on a Norwegian proposal for a bilateral program in biology and ecology, including polar bear studies covering Svalbard, Frans Josef Land and the northern Barents Sea, the Soviet delegates insisted on restriction of the study area to just Svalbard and the waters west of the Soviet sector line. This geographical limitation made the program scientifically useless, and was also politically unacceptable to the Norwegian government. The USSR has also tried to impose the same geographic limitation on other Soviet-Norwegian scientific co-operation in the high Arctic.

On the other hand, the fishery research co-operation in the ice-free part of the Barents Sea between Norway and the USSR has worked well over a number of years, and the vessels have been operated independently of national boundaries. In this case economic interests seem to have had the upper hand.

It is often said that the reason for the Soviet attitude to international scientific co-operation in the Arctic is the need to protect military bases or other parts of their security system. This is certainly true, but not the whole truth.

The Soviet Union from the very start has paid great attention to its Arctic territory, and has used much greater resources relatively and totally in manpower and money for Arctic research than the western Arctic rim nations. This has led to the discovery of great mineral and energy resources, which now are being exploited in the Kola peninsula and other places along the Soviet Arctic coast. Much of the Soviet research money is spent on developing transport routes in order to bring these resources to the markets. The USSR, therefore, has great

economic interests to protect in the Arctic.

Not all Soviet research in the Arctic is of high quality, but the efforts by thousands of their scientists over a long time have resulted in a vast amount of data — some of it classified — in Soviet institutes and archives, which in their opinion surpasses the combined knowledge in the West. Although not stating it expressively, leaders of Soviet Arctic institutes have indicated to me that they have little to gain by co-operation with western institutes. I am not tempted to consider this mainly an expression of superior Soviet thinking. If we want to obtain a better international scientific exchange and co-operation in Arctic science involving also Soviet institutes, one of the prerequisites is a considerable increase in western Arctic science.

Another barrier to the organization of international scientific co-operation on our side has been the lack of an adequate internal organization of Arctic research in many Western nations. In each Arctic country there is a need for a committee or an institution of some kind to co-ordinate national activity, and to serve as an information center and contact organization in international relations. I am convinced that we shall not get a long-lasting and effective structure for international and interdisciplinary co-operation in the Arctic until the major Arctic nations in the West arrange for a better structure of their own Arctic research. I have expressed this need on many occasions, and I am pleased to note that the US, Canada, Denmark and Sweden are in the process of remedying this deficiency.

International co-operation in polar science takes place in various ways, such as: large, co-ordinated regional or circumpolar single programs; part of global research programs; single agreed-upon programs between a restricted number of scientific organizations; programs organized and funded largely by one organization or nation, but with participation of foreign scientists.[2] These programs, successful as they may be, are mostly restricted in scientific scope. They last only a few years and usually result in only small and intermittent effects on the international polar scene — with one exception: I.G.Y., which gave birth to SCAR. The same can be said about the various mechanisms for achieving international co-operation in Arctic science: by governments (usually bilateral), international scientific organizations (usually single disciplinary) and by institutions (again most by only a few participants). The need for a broad, circumarctic and multidisciplinary organization, something like an Arctic SCAR, has been felt by Arctic scientists in many quarters and nations. A short review of some attempts to form such an organization during the time I have been a manager of polar science may be of interest.

At the general meeting of SCAR in 1968 the possibility of bipolar studies was discussed and the question of the international co-ordination of Arctic research was raised. The SCAR executive requested ICSU to advise how best to effect closer integration and co-operation between Arctic and Antarctic science, in particular whether it would be acceptable to expand SCAR or whether a separate organization for Arctic science was desirable. ICSU played the ball back by inviting SCAR to study the possibility of extending its range of interest to include the promotion of co-operation on scientific research in the Arctic, which SCAR undertook at a meeting in Oslo in 1970. The discussion clearly demonstrated a unanimous opinion among the southern SCAR nations against expanding SCAR's geographical area of interest. This was primarily due to fear of getting involved in the more controversial problems in the Arctic, thereby losing the gains obtained by the successful scientific co-operation in Antarctica. SCAR therefore recommended to ICSU that it would be most desirable for a separate Arctic organization, and asked ICSU to explore this idea and — if the response was favourable — to call a meeting of representatives of the respective scientific academies to discuss how to best proceed. SCAR reported that the six SCAR countries active in Arctic research indicated a desire to participate in such a meeting. The ICSU executive board discussed the proposal by SCAR at its next meeting, but it was met by Soviet opposition, and ICSU concluded that

[2] For further information on this aspect see E.F. Roots (1984).

the time was not opportune to proceed with the matter.

Despite the setback there were signs indicating the general political thaw of the 1960s extended also into the Arctic. Exchange of polar scientists was included in the general agreement on cultural and scientific co-operation between the USSR and Norway. In 1969 a sea-ice scientist from the Norwegian Polar Research Institute, on an exchange visit to the Soviet sister organization in Leningrad, was allowed to visit one of the drifting stations in the Polar Basin. This had not happened before and he was received with excitement and great hospitality wherever he passed en route to the station (North Pole XVI).

To explore the possibilities of a broader contact and co-operation between Soviet and Western Arctic scientists, I invited in 1972 A.F. Treshnikov, director of the Soviet Polar Institute (AANI), J.O. Fletcher, director of the Office of Polar Programmes, NSF, and E.F. Roots, head of the Polar Continental Shelf Project, Canada, for quiet and informal talks at my office in Oslo. We had a most friendly and open discussion, reported on the organization of polar research in the respective countries and on national plans for Arctic research, discussed projects suitable for international co-ordination and the exchange of information. However, by virtue of the fact that the three of us came from nations belonging to the NATO defence system and he himself from a nation adhering to the Warsaw Pact, Treshnikov made it clear that he was unable to take part in any international organization for Arctic research, neither could he accept co-operation in projects involving field work in Soviet territory. But Treshnikov suggested "we could meet on the ice." It so happened, in 1973 Soviet scientists accepted a US invitation to visit the AIDJEX project in the Beaufort Sea. Since then "colder temperatures" have again hit the Arctic and prevented even "meetings on the ice."

Later on, other attempts have been made to establish better co-ordination, exchange of information and planning of multinational and multidisciplinary Arctic science. In 1978-79, during meetings in Copenhagen at the invitation of the Commission of Scientific Research in Greenland — an organization called CHARLIE (the Committee for High Arctic Scientific Research, Liaison and Information Exchange) — was established. It consisted of a number of qualified polar scientists in their private capacity. After useful work for a couple of years it died away.

A little later another non-governmental organization, Comité Arctique International, was established by people from industry (mainly oil companies), governments and scientific institutions in order to "improve knowledge and understanding of Arctic areas, and to that end promote research in different fields on an international and multidisciplinary basis." The committee made a strong but abortive effort over three years to plan and organize a large scale study of the exchange of water mass and energy in the passage between Greenland and Svalbard, and has held a number of conferences.

In May 1984 senior scientists from a number of oceanographic institutes in most of the western Arctic nations established "the Arctic Ocean Sciences Board" in order to bring together financial and other resources into co-operative programs. The formation of this board is an interesting development for the oceanographical sciences in the Arctic, and its work will be followed with attention also by scientists from other disciplines. It may turn out to be an important element in the formation of a more comprehensive international scientific organization for the Arctic.

It should be noted, however, that none of these organizations have succeeded in obtaining the participation of Soviet scientists. The need for international scientific co-operation in the Arctic is steadily increasing. Within the field of fundamental science local, specialized studies must be supplemented by circumpolar, multidisciplinary and expensive programs, often involving sophisticated instrumentation, and satellite and computer technology. In the area of applied science all Arctic nations are looking for the same environmental information upon which to base an orderly and safe industrial development as well as governmental regulation and monitoring of the economic activity. The

Arctic nations have an even greater need than those of the Antarctic for an independent scientific body to provide advice requested by the political authorities on environmental and other scientific problems of circumpolar scope and significance, to co-ordinate relevant national research programs and to organize exchange of data. A carefully guided co-operation to this end would help to build mutual confidence among the Arctic nations, a necessary fundament for improvements in other international relations on the top of the world.

A new initiative is now under way. At an informal meeting of representatives of nations active in Arctic research present during the XIX SCAR meeting in San Diego last June, the question of an International Arctic Science Committee (ASC) was raised again. The terms of reference suggested are similar to those of SCAR. Although co-operation with ICSU is considered a prerequisite, the form of the contact is not yet defined. The time seems ripe for this initiative. The nuclear plant accident at Chernobyl has opened the eyes of the Soviet hierarchy to the value of international co-operation also in sensitive scientific areas. Hopefully, this new trend may extend into the Arctic.

The western Arctic nations should make every effort to persuade the USSR to join in an Arctic Science Committee, and for this purpose be prepared to accept Soviet conditions limiting the scope of the co-operation, as long as they don't cripple the committee. The ASC will have to start with a modest programme, and not move faster than all adhering nations can accept. Like SCAR, it should work according to the consensus principle.

If the USSR is not yet willing to join, despite concessions, the other partners may have to proceed without Soviet participation, hoping that the USSR some day will agree on G.W. Rowley's pertinent observation: "Many scientific problems are circumpolar in nature, require study on a circumpolar basis, and hence demand international scientific co-operation.... No nation can work in isolation and hope to keep in the mainstream of scientific progress" (1966).

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A North That Can Be Felt But Never Known

Stephen Hume
The Edmonton Journal
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T5J 2S6

I am not a scientist. Yet much of what I do as a journalist seems in some part to echo the functions of a scientist. Both begin with keen observation of events in the natural world. Both are committed to recording data as intelligently and objectively as possible within the unconscious framework of our biases and the limitations of our perceptions — social, cultural, philosophical or otherwise. Both are concerned with dispassionate understanding of how those data correlate. And both are concerned with attempts to draw meaning from the observed relationships or absence of relationships within the matrix of our available understanding.

We are not alone in this endeavour. Two other kinds of experts do precisely the same things, although for different purposes. The Inuit hunter applies to his pragmatic task all the skills I have just outlined. If the hunter resembles the scientist in the search for a prey that is a manifestation of reality, then it must be said that the poet resembles the journalist in the attempt to penetrate the scientist's reality with intuition and the intangibles of dreams and imagination.

What do poets have to do with scientists, hunters, journalists and the integration of tradition, technology and changing political aspirations that is the North in Canada today? A great deal — and they deserve much more attention than most of us pay them.

It is the scientist's objective to make people know things about the world they live in; to frame the conceptual architecture necessary to identify and evaluate the processes that make the environment we occupy.

It is the journalist's goal to make people understand what they come to know as a consequence of the work of scientists; to apply common sense and plain language to the abstractions and arcana of experts.

It is the poet's task to make people experience the intangible; to make them feel the meaning of their knowledge and their understanding of it; to open the heart to the unknown and the unknowable that surrounds even the greatest mind and the most penetrating insight.

Poets, to some extent, exist to make us feel humble as we play with our pebbles of knowledge at the edge of what Newton identified as the vast ocean of the never to be understood — an intriguingly poetic image for a mathematician to use as metaphor for his own sense of scientific ignorance. Poets attempt to take us beyond the physical parameters of understanding — beyond the concepts of distance, mass, temperature and time that define the boundaries of the quantifiable scientific world. Poets take us beyond the laws of physics, chemistry, biology, the technical detail of what we observe and report. Poets seek to take us into the spiritual and moral dimension of the North; to immerse us in the matter of what it means to the marrow and texture of our lives as Canadians.

The dimensions and landmarks of this spiritual landscape frequently seem alien and irrelevant in the context of Canada's scientific and political communities. The inherent values not being measurable, their validity is deemed suspect at best, and dismissed as the inchoate product of emotional sentiment at worst. At one point, invited to sit as a lay representative with a panel of academic referees passing judgment on the University of Alberta's Boreal Institute for Northern Studies, I was privy to a brief conversation with a bright young scientist of some accomplishment and reputation. Our chat passed over the eclectic and publicly accessible library of the Boreal Institute. He was bemused,

even offended, by the presence on the shelves of that library of a range of literary works — stuff of little concern to the serious academic, he said.

Imagine that! Novels and plays and poetry sitting there, spine to spine with the learned treatises upon which empirical academic knowledge of the North is built. He seemed to feel that somehow this clutter of creative literature got in the way of true understanding of Canada's northern realms. In fact, the reality is quite the opposite of that young scientist's perceptions. Excepting the voices of a few poets like the late Jerry Rush and E.J. Pratt; or the still-living voices of Al Purdy and J. Michael Yates, Canadians pay far too little attention to developing their spiritual and moral comprehension of the North. Yet it is precisely this kind of insight that provides the foundation upon which we may build the understanding essential to Canada's search for a nationhood capable of realizing its full and unique potential as a northern culture. If Canada has progressed beyond those pale reflections of 19th-century European society that still linger in Canada's central provinces, we can thank the vigorous eruption of Western realities into our national consciousness. Yet the West itself creates its own dangerous echoes of the American society to which its development has been so closely tied. Having substituted one set of reflections for another, we nevertheless remain at risk of accepting a national culture cloned from an experience not our own. The present power of these American images is such that we must listen to radio and television announcers in Whitehorse, Yellowknife and Edmonton struggling to master the drawling dialects of the American South. Thus the horizontal Chile that is Canada, laid in its skinny 200-mile strip along the United States border, turns its colonized back on a national hinterland wider from north to south than the Atlantic Ocean is broad. Thus does our popular culture take its sustenance, not from the rich and textured landscape that offers a distinctive voice, but from the linguistic monody of the American imperium. Today, this is the most important issue confronting anyone who cares about the context of Canada's future and the place of the North within that future.

I want to take the poet's liberty now, veering away from the abstract to plunge into the subjective intangibles of personal experience in my attempt to explain what I mean.

I first went north as a young graduate from the University of Victoria with a shiny new degree in anthropology, choosing the offer of a newspaper job over my college graduation ceremony. In my undergraduate program, I had been studying both circumpolar ethnology and the mechanisms of social change and I leapt at the opportunity to see the real thing. In those days my head was filled with classroom theories, the precise literature of scholarly ethnologists, and the whole hidden agenda of elegant preconceptions and assumptions that formal academic study substitutes for the vulgar stereotypes of the untutored and uninitiated.

So my first experience of Canada's North was one of crashing disappointment. All those carefully nurtured theories, those elegant arabesques of abstract thought, they all turned out to be as insubstantial as Arctic cotton — those little puff balls that strip down to nothing on the cold wind. I understood the implicit derangement of my values and insight the first time I went into Old Crow, one of the most ancient points of continuous human habitation on the Canadian landscape, and discovered that the scientific population out-numbered the Native population. This was at the height of planning for a mighty gas pipeline that was to sweep along the North Slope of Alaska from Prudhoe Bay, down the Mackenzie River valley and ultimately to the rich markets of Chicago and the American Midwest. Old Crow, a pretty dispersed settlement of log cabins strung along the Porcupine River, suddenly found itself with an airstrip capable of handling huge jet aircraft and a suburban annex of tents filled with scientists and engineers studying everything that moved — including each other. And yet that vast array of all that is best about modern science seemed curiously insensitive to the very thing it was there to protect, the fragile landscape and the people who had inhabited it for 10,000 years.

The standard joke among the Old Crow people went something like this: "You know, that

sociologist has moved out of my outhouse. He says the anthropologist downstairs makes too much noise." Staying with ordinary people and not in the sterile and artificial camp environment, I could only come to sympathize with their long-suffering and understated sense of humor. There was one story, probably apocryphal, but doing the rounds nonetheless, about a chap doing physiological research on the comparative metabolic parameters of Native people and Europeans. He'd rush up to people at the strangest hour and insist on taking their pulse. Middle of the night, walking home from your girlfriend's place — out of the shadows he'd lunge with stethoscope and blood pressure gauge. In bear country this is not guaranteed to make you a lot of intimate friends. I'm told he discovered that Native people in Old Crow were subject to mysterious surges in heart rate and rapid rises in blood pressure in the middle of the night.

Not long after my Old Crow epiphany, I sat in a sunny, flower-filled meadow on the banks of the Nahanni River listening to Ted Trindell, a wonderful old gentleman and Socratic-style philosopher from Fort Simpson. At our backs, the only woman in the party was bathing in a bubbling hot spring while Nick Sibbeston, not yet dreaming he would one day be the head of the Northwest Territories government, stood discrete watch with his rifle against the grizzlies who sometimes stray in to root for the wild onions that grow big and succulent in the warm ground. Ted himself worked swiftly with his double-bitted axe, shaping an empty 10-gallon gasoline drum into a drag anchor for the flat bottomed river skiff he wanted to keep bows-on to the turbulent current. While he worked, he observed that in his experience, the only PhD worth two cents was the one you got from his university.

And what university was that? I asked, in all the pomposity of over-educated youth.

He looked at me in amazement. "Why, the University of the Mackenzie River. I've been going to it since 1902 and I still haven't got my degree."

Ted was kind to me. He tolerated the follies of youth and I came to learn from him that there is as much knowledge and art within the long, wind-swept corridor of his immense university as I had found in the crowded, urbane corridors of my own.

During the rest of my stay in the North, my preconceptions blew away like snow on the wind. I use that image deliberately, because one of the things that I learned from Ted is that things are not always what they seem to be, that blizzards may not be blizzards and that open country with vast landmarks can be as confusing and obscure as the tangle of unmarked alleys in an unknown city. He taught me that in open country, blowing snow often hugs the ground. Blinded by ice crystals, you'd think it was a full blizzard, breath whipping away on a wind that cuts at exposed flesh like a sabre, all your familiar landmarks hidden and the whole North shrunk to the arm's-length dominion of the whiteout. Yet this is an illusion of place. Scramble up a cairn or a high boulder and your head pops out of a tumbling river of snow. Above, the stars are clear and bright and you search for Polaris and your bearings; below, the flood hisses and swirls about you, a strange concoction that is both solid and liquid. Nothing is as it appears to be, I learned, and my own illusions blew away on the wind of Ted's teaching. What replaced them was not knowledge, but a profound wonder at the subtle paradoxes of the place that occupies most of geographical Canada. It is a world rich in texture and detail as a needlepoint tapestry, yet austere as the rock scoured bare by its glaciers. It is complex and intricate, yet it has the simplicity of a world pared to the bone. It is brittle and delicate as the traceries of lichen embroidered into a thin mantle of life, yet the changeless horizons of pink granite, the huge machineries of sky and light, evoke a permanence to still the heart. The harshness of the terrain softens under the beauty of hue and the immensity of perspective. What seems absolute and stark, resonates with multitudes of possibilities — the heavens oscillate between total light and total dark; they fill with the magical migrations of birds; miraculous fish teem in waters so cold their body fluids would freeze if they did not seek the warmer safety of spring-fed lakes and streams in winter months.

In my years in the North, I visited all but two of the almost 80 settlements of the Northwest

Territories. I flew hundreds of thousands of miles. I flew as far, I calculate, as a trip to the moon — and to some places almost as remote.

One-time Commissioner of the Northwest Territories Stu Hodgson told me how, on the night of the first lunar landing, a visitor from the south pointed to the moon and told his Inuit companion that two American astronauts were walking around on it. The old hunter seemed bored by the idea. When asked why he wasn't impressed, he shrugged — shamans fly to the moon whenever they want to, he pointed out. Later, at a tiny hunting and trapping community called Spence Bay, I discovered for myself that the gap between shamanism and starflight is not such a big one in Canadian culture. Almost 3,000 kilometres north of Toronto, Spence Bay nestles into the naked arm of the Boothia Peninsula where it thrusts its way North to the ice-choked waters of Lancaster Sound and the glaciers of Devon Island, still waiting patiently for the next Ice Age and their chance to reclaim the continent. I had come to Spence Bay to talk to Ernie Lyall, a grizzled 30-year-man with the Hudson's Bay Company, justice of the peace, territorial agent. I wanted his entirely pragmatic views about the cost-effectiveness of plans to decentralize government services. Instead I wound up listening to Ernie's tale of travelling by dog team through the winter barrens near Fort Ross, the abandoned Bay trading post not far from Spence Bay. He had come across a hunting band's cluster of igloos, he said, and after long hours of bone-chilling travel by moonlight, decided to stop for tea, a rest and some human companionship. Inside, he found only the grim silence of two old people and their young daughter, who seemed to be dying.

There was nothing to be done, he said. No doctors, no medicine, no communications and no question of moving the girl to a settlement with a nursing station. Just his white man's uneasy anger at being confronted with circumstance in which all the knowledge of science and technology seemed valueless. Yet the parents were not without hope. They had called in a shaman to cure her with magic. It was very still and very cold and when the shaman came, the snow announced his arrival, squealing under the runners of his sled.

"That kid was lying on the one sleeping bench used by the whole family," he told me. "The bench was carved from snow and she was wrapped in the fur sleeping robes. Above the sleeping bench, her father had made a window of clear ice. He packed snow in a skin bag and held it next to his body. When it melted, he poured it out on a piece of smooth leather and it froze again into a transparent sheet. He fixed that pane of ice into the side of the snowhouse, not clear like glass but clear enough to let in the moonlight for his dying child.

"When the shaman came into the igloo, the full moon was shining right through this clear pane of ice, a pure silver pillar of moonlight falling out of the semi-darkness onto that girl like something from a movie. He told us to be still because he was going to call down his spirit familiars. Then he began to chant.

"They were these little dogs. I saw them clear as anything. They came out of the moonlight shining through that ice window. He had his arms raised over the girl, palms down. These little dogs ran down his arms and jumped to the floor. There were six or seven of them and they circled all around the sleeping bench where the little girl lay. My hair was standing on end like with static electricity — I practically bristled like a dog myself. All the huskies outside started to howl. It was unbelievable. These strange little dogs. I did see them. Then they ran back up his arms and out into the moonlight. He left without saying another word and two days later the girl got well."

Perhaps it was my demand for rational explanation, or the vague air of condescension in my academic speculations from the vast scholarly literature on witchcraft, in any event, Ernie insisted on pursuing my further education. I wound up spending the night in the company of a 66-year-old widow — as if I could distinguish between day and night in a country where the winter sun doesn't rise. Her wrinkled face and hands were criss-crossed with the blue shadows of tatoos that spoke from a world before white men, and I sat enthralled by her literary power as she told me how she became a shaman herself and recounted a fight with another shaman all

through one bitter February. Who was the enemy? She didn't know. The powers of some unseen foe from beyond the far hills. Today her story resonates with the bigger irony of what her people face from beyond the southern curve of the horizon.

Along that remote coast of the central Arctic, I met another old man who showed me the battered hide quiver he used in the days before rifles, before people like me. Our faces were so pale, he said, that at first it was believed we were descended from a mating of sled dogs with the moon — sort of human, but not real human beings. Human or not, he led me with patience through the naming of arrows and explained the fashioning of different tips for different game. This one for *siksik*, the small ground squirrel. This one for birds.

"What about this one," I asked of a slender point that looked like it had been hammered from the slim handle of a tarnished metal spoon. He didn't want to talk about that one, but I pressed him for an answer.

"That one," he said. "A long time ago, you know — that's one a man might use, say, if he wanted to get a wife." I didn't ask what man or what wife, but gazed at the beauty of pure design. It offered a perfect shape for slicing through the gristle and cartilage of an inconvenient husband's rib cage. And this is not so unusual. At one of Commissioner Hodgson's famous black-tie balls in Yellowknife, I was taken by one of the young Inuit interpreters to pay homage to a wizened old man sitting at the back. He grinned and I grinned and my escort looked wall-eyed, that uncomfortable stare that pleads: I've done my duty, let me go. "Why is he famous?" I asked. "Oh, he killed his enemies," I was told. "Before the RCM Police, he killed a lot of his enemies."

And more recently, the phone rang in my office, surrounded by glass-clad skyscrapers and the roar of traffic. My phone rang and it's an old friend calling to shoot the breeze, Peter Ernerk, who is my age. He was born in an igloo. He did not see his first white man until he was in his teens. Peter went on to a remarkable career as broadcaster, civil servant, politician — returning, in the end, to live on the land that had shaped him, using his new-found tools to fight for the rights of his people against unseen enemies from beyond the horizon. A modern-day shaman calling me up by satellite to chat about strategy for dealing with the anti-fur lobby in Europe that seems determined to destroy the economic base of subsistence hunting communities; about the prospects for a province called Nunavut for the submerged Inuit nation; about the moral evils of a constitutional accord that denies self-determination to Northerners, puts their right to an equal place at the table of Confederation in the hands of foreign premiers.

These are small examples not only of gulfs between cultures, but also bridges between the ages of man. We are indeed a people with one foot in the Stone Age and one hand reaching for the stars. In the North, down those long corridors of Ted Trindell's University of the Mackenzie River, we test sophisticated electronic weapons of global destruction. They fly over cemeteries filled with the victims of alcohol sold in the name of universal accessibility to government services, a concept that makes beer cheaper than milk for babies in some communities. Today, we co-operate with our supposedly mortal enemies, the Soviets, using satellite triangulation to find lost hunters, while our federal and provincial governments cannot find it in their shrivelled souls to settle claims with tiny Indian bands after half-a-century of shameful footdragging. Our own beggared people pleading help from the United Nations and foreign governments.

My undergraduate dreams evaporated in a flash in the face of these more powerful realities. Yet it continues to be the land itself that has had the most profound effect, not only upon my own imaginings of the North and what it means, but upon the collective consciousness of all those exposed to it.

While my classmates were obtaining their degrees at a convocation ceremony amid the pleasant, cultivated gardens of Victoria, I found myself adrift on the Beaufort Sea. We had been sailing to Herschel Island, where the RCMP used to breed their sled dogs for Arctic duty. The engine failed and while Vincent Steen struggled to find and fix the cause of falling oil pressure, I kept watch from the bridge as we drifted helpless

before a running sea. All along the horizon, the sky sparkled with a strange blue glitter. The quickening breeze carried distant booming sounds, groans and long electrical crackling. It was the polar ice pack standing off the Mackenzie River delta, grinding its teeth on the wind and currents of an Arctic giving painful birth to its spring.

I've forgotten much of the detail from that voyage, what was wrong with the engine, what kind of jury-rig Vincent assembled to get us home before the storm, but the image of the polar ice — the implacable force of it, waiting out there at the fringes of sight, waiting patiently for the lifting of the brief illusion that is a northern summer — that image is vivid in my memory.

This sense of vast forces playing across gigantic landscapes framed much of the personal experience from which my present convictions took their shape.

Head north from Yellowknife on the highway John Diefenbaker wanted to build to Coppermine and the road evaporates. Instead there is only the endless tundra, stark, treeless, marked by the tread of departed glaciers that will surely come again and which make man's scratchings insignificant. Fly over this in a slow DC-3, watching the small black shadow of the aircraft glide hour after hour over the worn escarpments, shattered ridge-backs and desolate moraines, and one realizes that the cloak of life here is as fragile as skim ice forming on a northern lake in September. Everywhere, despite the pretty summer dress of lichen, grass and wild flowers, the earth shows its bones beneath.

"You think we seek to own the land," says one Native voice from the North. "You are wrong. We cannot own the land. The land owns us." It is this bondage that Native land claims seek to affirm; it is the dominant society's obsession with property — with ownership rather than stewardship — that views such claims with suspicion and hostility.

To recognize this is to identify an important cultural difference that cannot be ignored in any move towards a resolution of the problem. We southerners believe we command nature with our science and our technology and our industry. We convince ourselves that we command nature, when it is clear to outsiders that we do not even command ourselves.

The late Jerry Rush, a teacher and poet who paid much attention to the North and its circumstances, observed in his last collection of verse, The Bones of Their Occasion, that

> wise men blast off for the waiting star.
> But nobody has filed a flight plan.

The prescient nature of his warning is clear to anyone who is sensitive to the moral imperative that insists Canadians deal with the spiritual substance of Native peoples who remain oppressed in their own land. Politically alienated, socially disenfranchised, their communities blown apart in the collision with the dominant culture, suffering the highest rates of unemployment, suicide, homicide, infant mortality — the present state of Native people in the South is both a denunciation of our priorities and a spreading stain upon the national conscience. Does this evil indifference await northerners, too?

Once, travelling through the Funeral Range of the Mackenzie Mountains, I deliberately took time by myself, alone in the deep boreal forest, listening to the slow unfolding of the wilderness. I say listening, because only when one takes the time to listen to the silence that is the absolute absence of man-made sound does one become aware of how we fill our lives with senseless chatter. In that wilderness I heard everything that Canada has been and will be. I suppose, after a fashion, it put me in touch with my country in a way that could not have happened otherwise. It put me in touch with myself, let me listen to the landscape that endures under industry and science. And that is how I came into the spiritual landscape of my country for the first time.

It is my thesis that the northern wilderness can tell us everything that Canada has been and will be. Some of us are listening to the messages and warnings that come to us out of the North; some of us are listening to the voices of poets and writers who seek to translate the difficult languages of the spirit. But too many of us are not listening. We think these questions of the spirit are simply chaff that confuses the true perception arising from the quantifiable realities of scientific research and academic analysis and

informed political deliberation. It is this divorce of political materialism and scientific pragmatism from the moral substance of the matter that should yield our gravest concern about the fate of Canada's North.

Partly it is because not enough of us have yet learned to accept the North as a spiritual reservoir for the nation. Not enough of us have learned that it is more than a kind of candy box of resources. Not enough of us have learned that our responses to the birth of new institutions and concepts of government in the North will frame the shape of things to come in our own future as a nation and a world state.

One of the major barriers to awareness is the attenuated vision of our political process. Aside from the pet projects of a few mandarins and the meandering thoughts of various Royal Commissions, our political institutions have no coherent vision of northern Canada that extends beyond the next federal election and across the lines of party discipline and ideology. There is no timetable for political evolution. There is no schedule for the diversification and growth that will be required for the future generations of this country with its high birthrates and rising expectations. There are only the opportunistic intrusions and knee-jerk reactions of visionless politicians, who stumble from crisis to crisis and expedience to expedience. There is only the dull and strident rhetoric of entrenched partisan logic and its conventional wisdoms.

We have the good fortune to inhabit a country that might be a metaphor for the biblical land of milk and honey. We have mineral riches beyond belief. Our coastal waters teem with fish. We are one of the few industrial nations with a real capacity for self-sufficiency in energy supply. We have vast renewable timber and hydro-electric potential. Our people are smart, resilient, hard-working and resourceful. Yet we have no integrated long-range strategy for developing science, technology and industry. We have no plan because most of our politicians share a fundamental inability to see beyond immediate problems and how they might impinge upon the next vote. A hundred years hence will this be seen as Canada's fatal flaw — the election of governments on the basis of superficial material promises rather than economic and social strategies shaped on the anvil of moral vision?

What has national economic strategy to do with the spiritual dimension of Canada's North? Today, it confirms that as a collection of distinct geographical and political regions, we Canadians remain trapped in roles established by the preconceptions of the previous century; trapped as firmly as I found myself snared by the preconceptions of my formal education. The similarities are not coincidence. The framework of 19th-century perceptions and attitudes by which the regions of Canada interact remains rooted in that same colonial psychology by which Canada evolved into a dominion from sea to sea. The function of our trans-continental railways, those instruments of national pride, was not merely to open the western territories, but also to gather the scattered resources of the country and concentrate them in Ontario and Quebec, where the confluence of cheap labor and capital could create a modern industrial manufacturing base. Western resources were to be processed efficiently and either exported or returned to the hinterland as finished goods. This is the formula for empire perfected by the British, and as Britain became a global power, so their colonial offspring in Canada became a member of the rich, developed world, and so Ontario and Quebec secured their place as the nation's industrial heartland, pumping manufactured goods back to the muscular limbs and extremities of the frontier.

But this is no longer the 19th century, it is almost the 21st. The hinterland is no longer a vast, empty space. It is populated with the vigorous descendants of industrious settlers, people with hopes and dreams for the determination of their own destinies.

If there was a great turning point in Canada's evolution as an industrial power, it came during World War Two, when the exigencies of global-scale battle management made it clear that some sort of national strategy for the rest of the century would have to be charted. Just as well-trained generals have a dismaying habit of trying to fight the next war with the strategies of the last one, federal governments with their

power base in central Canada continue to attack the problems of the future by looking to the successful past. Thus, in 1945, when the white paper on employment and income was presented to Parliament, it took its mandate from experience rather than creative foresight. In hindsight, the strategy that was to lead us to the next century was profoundly flawed. It was rooted from the outset in the national perspective of Ontario and failed to address the principal causes of Western grief during the Great Depression — a narrow, resource-based economy in need of diversification. So Canada's economy evolved to serve the needs of powerful central provinces, not to serve the vision of security through diversity; of a national economic architecture comprised of strong regional components.

If the management of Canada's post-war economy evolved from preconceptions laid down in the previous century, the consequence was that federal policy makers, wedded more than ever to their Ontario-Quebec power base, consistently ignored the regional dimension of the national consciousness. On those few occasions when economic policies did emerge to address regional desires and disparities, they were permitted to atrophy by succeeding governments. The continued service of these 19th Century attitudes and preconceptions ensures the continued failure of Ottawa to establish an agenda for self-determination in Canada's northern territories. I believe there is one other factor at work. The federal government has a deep psychological need to maintain some form of territorial base and will fight jealously to avoid any erosion of that base. If Ottawa maintains direct territorial sovereignty over the Yukon and the Northwest Territories, then it sits down to negotiate with provincial jurisdictions not only as a kind of abstract administrative entity, but also as a quasi-province. What else explains the explosion of federal agencies and authorities in the North that accompanied the awakening of a variety of home-grown political forces in the region? Today, despite rhetoric to the contrary, this federal presence forms a kind of parallel power to territorial autonomy. It is a way for Ottawa to compensate for the growing sense of independence that characterizes northern legislatures.

Many of the federal government's rationalizations for denying the northern territories the kinds of political and cultural self-determination they seek, clearly spring from the desire to maintain a kind of neo-colonial hegemony. It is from these obsolete ways of thinking that Ottawa continues to frame its standard arguments against rapid evolution toward autonomous government in the Yukon and Northwest Territories.

The first federal argument is that the population is too small. How can we justify for a tiny population of 70,000 people, control of a vast area with immense potential for development of strategic resources? The second argument takes aim at revenue generation and economic base. Since the Yukon and Northwest Territories depend upon federal subsidies, they must wait until revenues generated are sufficient to permit northern provincial governments to support themselves. Both these arguments are naked sophistries. They fix a greedy eye on purely material criteria and ignore the philosophy of freedom out of which Canada's other provinces were created and a national vision was shaped, however flawed its original conception of the role of regional economies.

It is a good thing for Alberta, Saskatchewan, British Columbia and Manitoba that such arguments did not prevail in the face of western aspirations for self-government a hundred years ago. Perhaps the visions of Canada were more sharply defined closer to the time of Confederation. The governments of the day seemed fired by the conviction that self-determination is not a privilege tied to material wealth and numbers, but is a right that flows from the fundamental principles of democratic philosophy.

All the western provinces, at the time they achieved provincial status, consisted of tiny populations in vast, economically undeveloped areas requiring federal subsidies long after self-government had been attained. In 1870, when Manitoba joined Confederation, the known population consisted of 11,963, of which only 1,500 were non-Natives holding the right to vote. Even with the rich Red River valley, Manitoba did not

export its first wheat until 1876, and that consisted of 857 bushels of seed stock to aid Ontario farmers who had been wiped out by bad weather and blight. By 1881, a full decade after provincehood, Manitoba's total mineral production amounted to four barrels of salt and 325 cubic feet of building stone. Only 25 years before Alberta and Saskatchewan became provinces, all the territories outside B.C. and Manitoba claimed only 55,000 people — the area that was to become Alberta had less than 20,000 people, many of them Native people with no vote. Manitoba was still receiving federal subsidies in 1930, 60 years after becoming a province.

At the time when the people of western regions achieved powers of self-determination within Confederation, they had little to offer beyond potential for growth and a moral case for government responsible to those who lived in the west. As this century opened, there was no good argument for denying Albertans control of their own destiny because they happened to number less than two per cent of Canada's population but also happened to occupy an area estimated to have 80 per cent of the nation's coal when it was king of the strategic minerals. As the century closes, there is no morally supportable argument that Northerners should be deprived of their democratic right to true self-government simply because their numbers are small and their country is vast and full of potential wealth of strategic importance.

Unless there are some radical changes in the political alignments of Canada, perhaps even changes in the fundamental structures of the nation, we stand to betray our visions of what our country can be and we place at risk the very substance that makes us distinctive as a people. Yet, if we are to formulate meaningful policy on the basis of what science tells us and technology enables; if we are sincere in a desire to integrate the traditional values of the North into this new framework, we must begin to absorb and acknowledge the power of the land to transform our inner selves — and the power of our writers and artists to convey this to us.

I am not talking about science. I am talking about magic. This is a word not much in vogue these days, equated with quacks and astrologers. But it is a legitimate word with a legitimate meaning. I am talking about the process by which we initiate ourselves into the mysteries that are knowable only in the purely subjective, personal and unique sense that is not quantifiable. The mysteries of Ernie Lyall's North, if you like.

It is upon the shoulders of Canada's scientific community that the great burden of environmental stewardship for the North has fallen. That community has done a valiant job of awakening Canadians to that responsibility; to our mighty obligation not to wound the great mother, nature herself, who sustains us and gives us life.

Who are to be custodians of the spiritual landscape? Who are to be custodians of our mythic sense of the North, a new mythos that is even now being forged from our relationships and obligations to the aboriginal peoples of that country? This mythos is of central importance to Canada as a nation. From it the Canada of the centuries to come will be defined, shaped, evolved into our own sense of northern nationhood.

We do not have the myths of Europe to sustain us. Those we have abandoned. The myths of our mighty neighbor to the south threaten to overwhelm us if we do not provide ourselves with vital alternatives. Nor can we simply assimilate the myths of our abused Native people — they belong only to those who are born into them. But we do have our own collective mythology, an important mythology. Ours is the mythology of vastness, of limitless austerity, of landscape that is both beautiful and merciless, of purity of line and unobstructed sight. Most important, ours is the mythology of small people in a huge, uncaring landscape. It offers a powerful corollary. That in a land so hard, people must have big hearts to live in it and much compassion for one another.

There is a moral imperative implicit in this emerging mythology. What we do in northern Canada establishes the destiny of Canada itself. What we are to become as a nation; a people; a culture — all this will be determined by what the North becomes under our stewardship. And what might it become? Perhaps simply another colonial treasure box of resources, to be raped and

cast aside, plundered for the enrichment of the many at the expense of the few. Certainly this is the hard truth which descends from events we must face in our national past. The grinding up of cultures in the mills of industrial expansion; the extermination of whole nations in the name of progress and political gain; the imperial occupation of the Native soul — these are the carrion birds of fact that squat behind us, however many fireworks we discharge to celebrate Canada Day.

Yet this is our primitive beginning and not necessarily a view of the future to which any of us need subscribe. There are growing signs that Canadians are coming to understand that our future is not necessarily chained to the dead in our ugly past; that it is indeed in our own hands at this moment in history. Our future is tied to the way in which we deal with our Northern heritage. Our strength will be defined by our relinquishment of power to those who have a right to it. Our weakness will lie in grasping for continued dominance and cultural rule over the weak among us. In this sense, the future immediately before us offers a kind of miracle: the capacity to alter in advance the past that future will inevitably become.

I must acknowledge here that I share strong sympathies for some of the proposals put forward by northern Native populations when they call for new and different kinds of government to help fulfil their national aspirations — their aspirations, not necessarily ours. It is not that I agree with the specifics of their proposals, but I heartily agree with the profound spirit of their argument. Many of them do not believe their interests are adequately served by existing institutions derived from European cultural traditions. It is difficult to argue with their assessment. Virtually denied a voice in our political forums, they experience the highest rates of unemployment and the lowest rates of university education for any distinct ethnic group in our society. They suffer frightful rates of alcohol abuse, family violence, environmentally associated illness — all those social disorders symptomatic of economic depression, political powerlessness and the consequent failures of self-esteem. All this after a century and countless billions of federal and provincial tax dollars spent to remedy the situation. So the argument that existing political institutions have failed Native people is valid. History demonstrates its undeniable proof.

Canada is a democracy, one of the best yet devised, and true democracy holds that whenever traditional political institutions fail to serve the needs of the people, we have not only the right to change them, we have an obligation to change them — to invent new ones if necessary. We are free people in Canada. The instruments of government belong to us; it is our responsibility to shape and structure them to serve our needs; and that includes the least among us, as well as the rich and powerful.

The Native people of the North offer us this wonderful gift. The opportunity to build the kind of fair and flexible society that can provide a model for the future in a world that is heartily sick of colonialism, imperialism, all the vicious mannerisms of ethnic, national and sectarian prejudice.

I am not one who advocates the preservation of northern culture like some sort of artifact in the museum of cultural anthropology. The only culture that can be preserved in this fashion is already dead and ossified. Canada's North is far from that. It is vigorous, vital, hungry to develop the skills of its people and the resources of their country. Indeed, to deny development of the North is to deny the people who live there the right to benefit from their patrimony.

And there is an ironic paradox in this. It is not possible for us to develop the North without inflicting irreversible change upon the existing culture. The satellite, the aircraft, the cellular telephone, the personal computer, the nuclear arms race — all these ensure irreversible change, and we may be absolutely certain that a measure of this change will be painful and injurious.

If there is a metaphor for the external imposition of change on the North, it lies in the story of the Kosmos satellite. While the rest of us witnessed the television and newspaper drama of a nuclear-powered Russian spacecraft in a disintegrating orbit, a small party of men savored their escape from the world and the

peaceful silence of their mid-winter wilderness trek across the barrens and into the Thelon game sanctuary. What kind of horrible scientific joke it was that these unaware people, camped in the most remote country on the face of the planet, should require the services of geiger counters and military radioactive decontamination teams.

Macchiavelli points out that it is sometimes necessary for a good prince to do wrong in the broader service of his people. The difference between the good prince and the bad is that the former understands the nature of what has been done, seeks to minimize its injury and feels remorse, even for what is inevitable. So what remains possible in our moral dilemma is for us to be cognizant of what we do. What is possible is that we may cushion the impact of our decisions. What is possible is for us to care that what we do is done in a fashion that fulfils our obligations to humanity; that eases the transitions imposed by the sciences, technologies, industries and political policies that we wield.

It is of fundamental importance to the health of Canadian society that we strive to do all in our power to prepare Northern people to take command of their own destinies to the greatest extent of their desire and potential. And that we have the dignity and decency to impose our continuing changes upon their culture with mercy, compassion, acknowledgment of our wrongs and in hope of their charity in forgiving our excesses and in accepting our redress where it is possible to make amends.

Finally, we should struggle to remember what it is of our current experience of the North that will endure. It is not our academic papers, however important the substance of their content. It is not the yellowed newspaper clippings of journalists or the dusty reports of bureaucrats or essays like this one.

It is only the land that will endure, and the True North of the imagination that emerges from the art of our poets and painters and writers. Inuit people themselves know this to be true. They are custodians of a rich tradition of poetry and oral literature. They understand that in this celebration of their language, they are stewards of their own intangible sense of connection to the landscape in which their generations dwell and which goes on, and on, and on, beyond science and government and art.

I have paid a good deal of attention to poetry and its importance to our conceptualization of the North and its ability to help us bridge the gulfs between technology and cultural tradition by adding a spiritual dimension to this vast geographical landscape.

Perhaps it is fitting to close with a poem. This is a traditional song collected among the Kitlinguharmiut by the explorer Knud Rasmussen more than 60 years ago. I've borrowed it from a small anthology collected by poet John Robert Colombo, who borrowed it from Rasmussen, who in turn borrowed it from the nameless Inuit singer so long ago.

> And I think over again
> My small adventures
> When with a shore wind I drifted out
> In my kayak
> And thought I was in danger.
> My fears,
> Those small ones
> That I thought so big,
> For all the vital things
> I had to get and to reach.
> And yet, there is only
> One great thing,
> The only thing:
> To live to see in huts and on journeys
> The great day that dawns,
> And the little light that fills the world.

Voices like these, and like the voice of Jerry Rush, who taught for many years in the Eastern Arctic and is gone from among us. The voices of Pratt and Purdy and Yates. The images of Toni Onley and Arthur Lismer, A.Y. Jackson, Sheila Hodgkinson and Lawren Harris. The voices and visions of these poets and painters who conjure for us a North that can be felt but not known — these are the little lights that grow to fill the world of Canada's spirit. Let us take them into our hearts and use them to inform and illuminate the shaping of public policy for the Northern heritage that makes us what we are.

Northern Canada

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